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ARMSTRONG (T.). **Life-history and Ecology of the Plum Curculio, *Conotrachelus nenuphar* (Hbst.) (Coleoptera: Curculionidae), in the Niagara Peninsula, Ontario.** — *Canad. Ent.* **90** no. 1 pp. 8-17, 1 graph, 11 refs. Ottawa, 1958.

Conotrachelus nenuphar (Hbst.) has increased in importance in the Niagara Peninsula of Ontario since 1946, and investigations on its bionomics, ecology and control were accordingly made during 1950-55. Those on its bionomics are here described, and the following is based partly on the author's summary of the results.

The fruits preferred are apricots and nectarines, neither of which are grown to any extent, but many others are attacked. Injury is severe on peach, pears are often scarred and deformed, though the larvae cannot develop in them, and isolated infestations occurred on gooseberry in 1949 and 1954. There was only one generation a year. The overwintered adults left their hibernation quarters between 22nd April and early July, and the females oviposited from early June, when the young fruits were beginning to swell, until the beginning of August. Under optimum conditions, the adults were long-lived and many survived for up to 17 months. In the insectary, the oviposition period lasted an average of 34 days, the combined egg and larval stages occupied slightly more than 20 days, and the period required for full-fed larvae to develop to the adult stage and for the adults to emerge from the soil lasted 32-45 days. The newly emerged adults left the soil between 12th July and 16th November and fed for a time before entering hibernation. Larvae failed to survive in dry soil, and adults did not emerge from soil that had dried out over a period of 45-60 days until moisture was added. Prolonged lack of moisture increased the mortality of adults in the soil. Most of the adults overwintered on the surface under mulch and other débris: type or depth of ground cover did not materially affect winter mortality.

The commonest parasite of the larvae was *Aliolus* (*Triaspis*) *curculionis* (Fitch). The adults of this Braconid appeared in early June; the full-fed larva left the host larva when the latter entered the soil, and it then constructed a cocoon from which the adult emerged 19-46 days later. Adult emergence began between 6th and 13th July and ended between 27th September and 17th October, over 75 per cent. emergence occurring by the end of July. In 1953 and 1954, there was a partial second generation, with peak emergence during the week ending 8th September. The percentage of females varied from 52 to 61. Adults that emerged in summer or autumn did not survive the winter in captivity, and no adults emerged in spring from late-developing host larvae that overwintered in soil cages. The percentage parasitism in an unsprayed plum orchard varied from 7.5 to 26.6, with an average of 20, and amounted to about 5 in an unsprayed peach orchard.

MACLELLAN (C.R.). **Role of Woodpeckers in Control of the Codling Moth in Nova Scotia.** — *Canad. Ent.* **90** no. 1 pp. 18-22, 18 refs. Ottawa, 1958.

The following is based partly on the author's summary. The eastern hairy woodpecker, *Dryobates villosus villosus*, and the northern downy woodpecker, *D. pubescens medianus*, were shown in experiments to afford important control of *Cydia* (*Carpocapsa*) *pomonella* (L.) on apple in Nova Scotia. In 1950-56, these birds reduced populations of overwintering larvae on sample areas on tree trunks in several orchards by an average of 52

per cent. and in some by over 90 per cent. Counts in the autumn of 1956 and the spring of 1957 showed that *D. v. villosus* was responsible for 67 per cent. of the control due to the two woodpeckers. In 1951-56, only 3 per cent. of the larvae taken by woodpeckers were parasitised by *Ascogaster quadridentata* Wesm., whereas 14 per cent. of those that escaped were attacked by this Braconid, which is the only important parasite of *C. pomonella* in Nova Scotia. The effect of the birds is thus largely supplementary to that of the parasite.

ANDERSON (N.H.) & MORGAN (C.V.G.). **Life-histories and Habits of the Clover Mite, *Bryobia praetiosa* Koch, and the Brown Mite, *B. arborea* M. & A., in British Columbia (Acarina: Tetranychidae).** — *Canad. Ent.* **90** no. 1 pp. 23-42, 9 graphs, 57 refs. Ottawa, 1958.

The authors briefly review the common names, distribution, bionomics and food-plants of mites of the complex of *Bryobia praetiosa* Koch and record investigations in 1952-55 on the bionomics of the two forms recognised in British Columbia, of which one, described as *B. arborea* Morgan & Anderson, attacks fruit trees and the other, *B. praetiosa*, infests herbaceous plants and sometimes enters houses; both are parthenogenetic [*cf. R.A.E.*, A 47 118]. The following is based partly on the authors' summary of the results.

B. arborea was found only in orchards and was confined to the aerial parts of the trees. It passes the winter in diapause in the egg stage on twigs and branches. On apple, hatching of the winter eggs begins at the late delayed-dormant or early pink stage of bud development and continues until full bloom. The adult females survive for 2-3 weeks and probably lay about 30 eggs each, singly on twigs and leaves. There are up to four generations a year, with peak populations in the latter part of May, mid-July, mid-August, and late September or early October, but deposition of winter eggs begins in June and continues until October, when the last adults die, so that small proportions of the population produce only 1-3 generations. The mites do not migrate, except from leaves to twigs and small limbs. Apple is the preferred food-plant in the Okanagan Valley, but plum and prune are sometimes damaged; the mite also occurs on cherry, pear and peach, but is of no importance on them, and rarely attacks apricot. As a result of feeding, scattered discoloured areas develop on the leaves, which become pale green, then yellow and finally bronze in colour and, if severely attacked, thin and leathery; feeding on the flower buds hinders their opening, and the leaf buds may also be damaged. Several predators were observed feeding on the mites. *Typhlodromus tiliae* Oudm. readily attacked all stages in coastal areas of British Columbia, but was rare in the Okanagan Valley, and *Chilocorus stigma* Say and *Campylomma verbasci* (H.-S.) are also probably of some importance, though predators are regarded in general as affording little control.

B. praetiosa infests a wide range of herbaceous plants, but is seldom found on the aerial parts of trees. It is considerably more tolerant of cold than *B. arborea* and becomes active at temperatures only slightly above freezing-point. It overwinters in all stages but chiefly in the egg, under the bark-scales of tree trunks, in cracks in fence posts, or in other dry, protected sites in buildings or elsewhere [*cf.* 31 364]. The number of active mites overwintering and the percentage in each stage depends upon autumn weather conditions. Hatching of the winter eggs begins early in spring, usually a month or more before that of *B. arborea*, when maximum temperatures reach 40-50°F., and one generation is completed during the spring

and early summer months. Most of the eggs deposited by mites of this generation aestivate until September, but some hatch in early summer and give rise to several (probably fewer than five) summer generations. Aestivated eggs begin to hatch about September, and only one generation is completed during the autumn. Feeding by individual mites produces winding etiolated trails on the leaves of the food-plant, and if infestation is severe, the foliage may turn yellow or brown and wilt; flowers are also attacked. Adults of the spring generation enter houses in numbers in May. The only predators observed were *Anthocoris melanocerus* Reut., *Typhlodromus cucumeris* Oudm., and an unidentified Bdellid mite, of which the last appeared to be the most important, occurred on cover crops and the trunks, but not the foliage, of fruit trees, was active from early spring to late autumn and attacked most stages of *B. praetiosa*. *T. cucumeris* fed on the eggs and immature stages, but was most active in the field when only the aestivating eggs occurred, which it probably does not seek out. *A. melanocerus* was commonly associated with *B. praetiosa* only from late autumn to early spring, since it hibernates in similar situations.

Both *B. arborea* and *B. praetiosa* first became of importance in the Okanagan Valley in 1950, at the beginning of a period (1949-54) in which the average annual rainfall increased from 10.7 to 12.1 in. and temperatures were below normal. In the summer of 1955, which was hot, populations of both mites declined.

MARTIN (J.L.). **Observations on the Biology of certain Tortricids in young coniferous Plantations in southern Ontario.** — *Canad. Ent.* **90** no. 1 pp. 44-53, 2 figs., 15 refs. Ottawa, 1958.

Since 1953, serious damage has been caused in plantations of young conifers in southern Ontario by Tortricids that live primarily on herbaceous plants growing in the furrows but sometimes feed on the young shoots of pine and spruce in early summer. *Tortrix alleniana* Fern. and *T. pallorana* Robs. are the commonest, but they are sometimes accompanied by small numbers of *Choristoneura* (*Archips*) *rosaceana* (Harris), *Sparganothis sulfureana* Clem. or *S. unifasciana* Clem.; the immature stages of *T. alleniana* are briefly described, and a key for the separation of the larvae of all five species is included.

The bionomics of *T. alleniana* and *T. pallorana* were studied in the field and laboratory. *T. alleniana* had one generation a year. The eggs were laid almost entirely on white sweet clover (*Melilotus alba*) and lucerne, though larvae were observed feeding on some ten other herbaceous plants and nine trees, including Scots pine (*Pinus sylvestris*), white pine (*P. strobus*), jack pine (*P. banksiana*) and white spruce (*Picea glauca*). The eggs were deposited on the upper surface of the leaves in masses of 19-141 in early June. The larvae hatched in about 15 days and fed on the young, folded leaves on the upper parts of the plants until mid-August. They then constructed silken shelters within the webbed leaves, in which they hibernated. Feeding was resumed in early May, when each larva webbed together several leaves. In early June, some larvae on plants other than *Melilotus* or lucerne migrated to young trees or shrubs not more than about 3 ft. in height, on which they webbed the leaves or shoots together and fed within the sheath so formed. Pupation took place in the sheath in mid-June, and the adults appeared about a fortnight later. The Tortricid was attacked by several parasites, which are listed; they killed 2-12 per cent. of the larvae and up to 4 per cent. of the pupae.

T. pallorana [*cf. R.A.E.*, A 25 189] also fed chiefly on *Melilotus alba*

and lucerne, and attacked *Pinus sylvestris* and *Picea glauca*. Its life-history and habits in general resembled those of *T. alleniana*, but there were two generations a year, eggs laid in late June giving rise to adults in late August. About nine parasites attacked this species and destroyed 13 and 1.8 per cent. of the larvae and pupae, respectively. The bionomics of *C. rosaceana*, *S. sulfureana* [*cf.* 26 562] and *S. unifasciana* appeared to resemble those of *T. pallorana*; the only conifer on which they were found was *Pinus sylvestris*.

All five species caused similar damage to conifers, which they attacked in May or early June, when the young shoots had elongated and shed their scales but before the lateral ones had spread away. The shoots may be completely destroyed or damaged on one side only, causing the tree to become deformed. The larvae fed for only a few days on rapidly growing trees, which they left before causing any appreciable damage, but for about two weeks on slower growing ones, on which they pupated. On *P. sylvestris*, the terminal shoots, which are the first to develop, were preferred on trees up to 10 in. in height and the lateral ones on those up to 32 in. *Picea glauca* was not seriously damaged, since the terminal shoots, which are the last to develop, were not attacked and the lateral shoots are sufficiently numerous to render the loss of up to three of little consequence. The larvae appeared to move for an average distance of only about 1 ft. between food-plants. Damage to conifers is therefore most likely to occur 2-4 years after planting, since before this time, the wild plants in the furrows consist of annual weeds, and after it, of grasses. Infestation was light in plantations where lucerne and *Melilotus* were abundant and heavy where they were scarce, and effective control might be achieved in the latter by the removal and destruction of these plants between oviposition and hatching. With increased planting of conifers for commercial purposes and for watershed improvement, damage by the Tortricids is likely to become of increasing importance, since although there was a slight indication of a cycle of abundance lasting for about five years, parasitism and disease were of low incidence, and injurious populations may persist for indefinite periods.

HENSON (W.R.). **A Temperature Gradient Apparatus for small Insects.**— *Canad. Ent.* **90** no. 1 pp. 54-59, 3 figs., 3 refs. Ottawa, 1958.

The following is the author's abstract. An apparatus which provides a temperature gradient within a small enclosed space is described. Provision is made for control of absolute humidity within the apparatus so that the same temperature gradient may be used with a variety of humidity gradients. The system of temperature measurement and recording and the operating characteristics of the machine are described.

HOLLING (C.S.). **A radiographic Technique to identify healthy, parasitized, and diseased Sawfly Prepupae within Cocoons.**— *Canad. Ent.* **90** no. 1 pp. 59-61, 1 fig., 4 refs. Ottawa, 1958.

In the course of work in Canada on the reactions of small mammal predators to sawfly cocoons containing healthy, parasitised or diseased prepupae, a radiographic method enabling the cocoons to be classified without being opened was found useful and is here described. Soft X-rays (wave-length longer than about 0.25 A°). were used; these pass through objects of low density and produce a shadow image on fine-grain film in

contact with them, and they were derived from a machine with an X-ray tube having a rotating anode, which was operated at the lowest possible voltage (20 kv.). The cocoons were exposed on a frame of thin lucite, which was placed over a sheet of film in an envelope of thin black photographic paper. The clearest radiographs were obtained from exposure for 13 seconds at an amperage of 75 ma. The radiographs permitted the detection within cocoons of *Neodiprion sertifer* (Geoff.) of *Dahlbominus fuscipennis* (Zett.), larvae or pupae of *Exenterus canadensis* Prov., sawfly prepupae attacked by fungus, and healthy prepupae, and 200 cocoons, subsequently dissected, were correctly classified from them. The technique was also used successfully with cocoons of *N. lecontei* (Fitch), *N. pratti banksianae* Rohw., and *N. swainei* (Middleton).

KASTING (R.) & MCGINNIS (A.J.). **Note on a Method of artificially sustaining Larvae of the Wheat Stem Sawfly, *Cephus cinctus* Nort. (Hymenoptera: Cephidae).** — *Canad. Ent.* **90** no. 1 pp. 63-64, 2 refs. Ottawa, 1958.

The larvae of *Cephus cinctus* Nort. feed singly within wheat stems and are structurally adapted for this habitat [*cf. R.A.E.*, A 43 436]. In attempts to rear them in the laboratory by artificial means, drinking straws packed with a synthetic diet and plugged at each end with damp cotton-wool proved more satisfactory than test-tubes, small-bore glass tubing or grooved plastic trays. The straws were kept upright at room temperature in a water-saturated atmosphere, and, when transferred to fresh ones every 24 or 48 hours, the larvae survived for an average of 14 days. Some of the straws were cut and grooved by the larvae, and head capsules and cocoons were found in some, indicating that the environment was adequate. Several diets were tested, but none proved satisfactory. Some larvae increased temporarily in weight and survived for about two weeks when fed on a mixture of vitamin-free casein, yeast extract, cellulose powder, anhydrous lanolin, various mineral salts and water, in which the protein content was comparable to that of wheat stems, and a similar mixture in which the proportions of casein, yeast and lanolin were increased and that of cellulose greatly reduced. Larvae reared on a diet of cellulose, casein and wheat-stem juice lost weight and did not survive for so long, and others reared on cellulose powder mixed with water also lost weight but survived for over 25 days.

DOBSON (R.C.). **Granulated systemic Insecticides on established Stands of Alfalfa for Control of the Spotted Alfalfa Aphid.** — *J. econ. Ent.* **51** no. 2 pp. 122–125, 4 graphs, 1 ref. Menasha, Wis., 1958.

Therioaphis maculata (Buckt.), the most important insect pest of lucerne in New Mexico, has proved difficult to control, because high winds or irrigation procedures may delay insecticide applications, low temperatures may reduce their effectiveness, and coverage of stubble or young plants may be poor. Systemic insecticides, applied to the soil in granules, were therefore tested in 1956–57. Quantities given are of actual toxicant per acre.

In a preliminary test, Thimet [O,O-diethyl S-ethylthiomethyl phosphorodithioate], Bayer 19639 [O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate] and Bayer 23129 [O,O-dimethyl S-2-(ethylthio)ethyl phosphorodithioate] were broadcast at 1 lb. on 16th October 1956, when the plants were

4-5 in. high and heavily infested, and the field was irrigated by flooding within six hours. Counts made on 24th October, when untreated plots and those treated with Thimet were both covered with honeydew, but those receiving the other compounds had suffered no apparent damage, showed 17, 34, 14 and 23 winged and 681, 524, 33 and 155 wingless aphids per 20 samples, respectively.

In subsequent tests, applications of Thimet at 1 lb. and Bayer 19639 at 0.5 or 1 lb. were made to spring-sown lucerne on 25th April 1957, when the plants were 4-6 in. high. Counts on 29th April and 2nd, 6th, 8th and 16th May showed that both materials controlled rapidly increasing aphid populations for 11 days and that thereafter Bayer 19639 at either rate was more effective than Thimet. The same treatments, applied on 18th June, when the plants were about 6 in. high, immediately before watering, controlled a relatively static infestation, whereas Am. Cyanamid 12008 [O,O-diethyl S-isopropylthiomethyl phosphorodithioate] at 1 lb. was ineffective.

When applied to the stubble of five-year-old lucerne, on 4th May, after the first cutting and followed by irrigation seven hours later, Bayer 19639 and Thimet at 1 lb. reduced a very heavy infestation and kept it low for 11 days, after which they lost their effectiveness slowly and rapidly, respectively; Bayer 19639 at 0.5 lb. kept numbers low for six days. On untreated plots, aphid numbers steadily declined because the very high population reduced the attractiveness of the plants, destroying them almost entirely by the end of the season. An application of Bayer 19639 at 1 lb., followed by irrigation, to plots in the same field on 18th June, when the plants were 6 in. high and the aphid population was considerable, but declining rapidly, reduced the numbers to a low level and resulted in virtually undamaged hay at harvest on 25th June; the same material at 0.5 lb. and Thimet at 1 lb. were less effective, but reduced infestations below the economic level, and Am. Cyanamid 12008 was ineffective.

WALLACE (D.R.) & SIPPELL (W.L.). **First Records of two Pine Sawflies in Michigan.** — *J. econ. Ent.* 51 no. 2 p. 125, 4 refs. Menasha, Wis., 1958.

Neodiprion swainei (Middleton), which had hitherto been recorded in the United States only in Wisconsin [*cf. R.A.E.*, A 42 97], was found on jack pine (*Pinus banksiana*) in the Chippewa, Luce and Mackinac Counties of Michigan on 21st August 1957; the larvae were mainly in the fourth instar and were typical for the species, and examination of the old egg clusters, found near the feeding sites, confirmed the identification in each case. Other larvae of the same genus observed feeding on *P. banksiana* in Mackinac County were probably *N. nigroscutum* (Middleton); a single female was reared and found to agree reasonably well with the original description and recent keys.

STELZER (L.R.) & FLUKE (C.L.). **Soil Insecticides for Plum Curculio Control in Wisconsin.** — *J. econ. Ent.* 51 no. 2 pp. 131–133, 8 refs. Menasha, Wis., 1958.

Observations in 1955 on soil treatments for the control of *Conotrachelus nenuphar* (Hbst.) in orchards in Wisconsin, applied in 1951 or 1952 [*cf. R.A.E.*, A 43 427], showed that aldrin and dieldrin in wettable powders continued to give excellent results, whereas chlordane and lindane

[almost pure γ BHC] were less effective; EPN [O-ethyl O-p-nitrophenyl phenylphosphonothioate], which gave poor results to begin with, appeared to have increased in effectiveness.

In a clean-cultivated cherry orchard, applications of 2 or 4 lb. wettable aldrin, dieldrin or heptachlor in 500 U.S. gal. water per acre with a ground-spray boom in July 1954 all gave significant control in the same year and almost completely prevented adult emergence, under conditions of very low infestation, during the next two years. When granular formulations were applied with a dry-fertiliser spreader to heavy grass cover in a young apple orchard in October 1955, 5 lb. heptachlor and 5.6 lb. dieldrin per acre gave effective control, but less than similar doses in sprays, and 5.6 lb. aldrin was ineffective, as shown by adult emergence in August and September 1956, after cages stocked with infested fruits had been placed over the plots in July.

COX (H.C.) & BRINDLEY (T.A.). **Time of Insecticide Applications in European Corn Borer Control.** — *J. econ. Ent.* **51** no. 2 pp. 133–137, 2 figs., 14 refs. Menasha, Wis., 1958.

The following is based on the authors' abstract. Experiments on the timing of insecticide applications for the control of *Pyrausta nubilalis* (Hb.) on maize were carried out in Iowa in 1951–56. An emulsion spray was applied to give 1.5 lb. DDT in 10 U.S. gal. water per acre, and one and two applications were compared. Two applications gave significantly better control than one in all tests, and the best control each year was given by treatment when oviposition was almost completed. The optimum dates of treatment for the six years were calculated statistically and are compared with those resulting from the various methods that have been advocated for their determination. A tassel-ratio index of 35 appeared to be more suitable than the recommended range of 30–50 [*cf. R.A.E.*, A **40** 229].

In five of the years, the number of borer-degree days accumulated before the date of optimum treatment was below the suggested 1,100 [*cf.* **41** 146], averaging about 900, and plants in plots showing the best control were consistently taller at the time of treatment than the recommended 35 in. The accumulated number of egg-masses per 100 plants proved unreliable [*cf.* **41** 357], and though data on moth emergence were consistent with recommendations, this criterion is unsuitable for use by the average grower. The recommendation to apply insecticides when 75 per cent. of the plants show evidence of recent feeding in the whorls was the most rapid and simple to use.

LANDIS (B.J.), SCHOPP (R.) & KLOSTERMEYER (E.C.). **Further Studies with systemic Insecticides against the Green Peach Aphid on Potatoes.** — *J. econ. Ent.* **51** no. 2 pp. 138–140, 4 refs. Menasha, Wis., 1958.

In field tests to compare systemic insecticides with parathion for the control of *Myzus persicae* (Sulz.) on late-crop potatoes in Washington in 1955–56 [*cf. R.A.E.*, A **45** 184], seed pieces were planted in the last week of May and treatments begun when the plants were 4 in. high.

Applied on 12th and 22nd July 1955, when very large numbers of winged aphids were entering the fields, sprays of 2 lb. schradan or 1 lb. demeton [diethyl 2-(ethylthio)ethyl phosphorothioate] in 25 U.S. gal. spray per acre

gave promising results, whereas 0.5-1 lb. Thimet [O,O-diethyl S-ethylthiomethyl phosphorodithioate], Guthion [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate], Am. Cyanamid 12008 [O,O-diethyl S-isopropylthiomethyl phosphorodithioate] and Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate] did not, and 0.75 lb. parathion was fairly effective on the first but not on the second date. After a third application on 5th August, 1.5 lb. Thimet or Am. Cyanamid 12008 gave excellent and 0.75 lb. parathion good control, probably owing to reduced influx of winged migrants; schradan and demeton were not applied again on the last date, but the earlier applications of schradan were still giving good control, so that this material appeared to be the best of the systemic insecticides.

In sprays applied at 20 U.S. gal. per acre in 1956, 0.5 lb. schradan or diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] per acre gave unsatisfactory results when applied on 29th June, during a period of heavy aphid immigration, and, although 1-2 lb. schradan reduced numbers considerably on the third and seventh and 1-2 lb. diazinon on the third day after treatment, neither these nor mixtures of them gave adequate reductions on the 13th day. Rather better results were obtained from applications on 13th July and much better ones on 3rd August, after the peak of migration, when 0.5 lb. schradan with 2 lb. diazinon and 1-2 lb. schradan alone or with 0.5, 1 or 2 lb. diazinon per acre gave practically complete control for at least seven days and some protection after 17 days; 0.5-1 lb. diazinon alone was ineffective and 2 lb. diazinon alone and 0.5 lb. schradan alone or with 0.5 or 1 lb. diazinon, inadequate. There was no indication of antagonism between these compounds, but their combination offered no practical advantage.

NISHIDA (T.). **The Influence of Yeast Hydrolysate on the Behavior of the Melon Fly.** — *J. econ. Ent.* **51** no. 2 pp. 140—143, 4 graphs, 6 refs. Menasha, Wis., 1958.

In further tests in Hawaii in 1955—56 on the attractiveness of yeast hydrolysate to adults of *Dacus cucurbitae* Coq. [*cf. R.A.E.*, A **46** 446], applications of 1—4 lb. hydrolysate per 100 U.S. gal. to plants of *Crotolaria incana* in a heavily infested, abandoned watermelon field resulted in greater numbers than occurred on untreated plants for the first day, but the numbers fell subsequently and were equal to those on untreated plants, or lower, after three days. Counts of dead adults under various plants sprayed with malathion and yeast hydrolysate showed more beneath plants that were attractive to the flies but not used by them for breeding than beneath favoured food-plants, such as watermelon and cucumber, and also more than resulted from the exposure of sprayed plywood slabs. Treated plants of the former group apparently attracted flies from untreated ones when the population density was high but not otherwise, and treated food-plants did not attract them from untreated plants of either category. It is concluded that the field response is primarily to the plant and only secondarily to the bait.

SHANDS (W.A.), SIMPSON (G.W.) & WAVE (H.E.). **Effect of low Temperatures on Survival of Stem-mother Aphids in northeastern Maine.** — *J. econ. Ent.* **51** no. 2 pp. 144—145, 4 refs. Menasha, Wis., 1958.

Observations on the development of potato-infesting aphids on their

primary food-plants in spring have been made in north-eastern Maine for many years. In 1956, heavy mortality of the fundatrices of *Macrosiphum solanifolii* (Ashm.) on *Rosa palustris* and of *Aphis abbreviata* Patch on *Rhamnus alnifolia* occurred, mainly towards the end of the nymphal stage, after an extended period of subnormal temperatures. A sharp fall in temperature, from 56°F. on 6th to 20° on 7th May, caused no appreciable immediate mortality of *M. solanifolii*, and persistent low temperatures throughout the developmental period, averaging 5.3°F. below normal in May, are considered to have been responsible. These prolonged the development of *M. solanifolii* from three to six weeks, possibly making the aphid more susceptible to particularly low temperatures on 24th and 25th May, and also possibly reducing the quality and quantity of the foliage available as food.

KROHNE (H.E.) & LINDGREN (D.L.). **Susceptibility of Life Stages of *Sitophilus oryza* to various Fumigants.**—*J. econ. Ent.* **51** no. 2 pp. 157–158, 1 ref. Menasha, Wis., 1958.

In experiments in which batches of adults and samples of wheat containing laboratory-reared eggs, larvae or pupae of *Calandra* (*Sitophilus*) *oryzae* (L.) were fumigated at different rates for two hours at 80°F., the resulting LD95's showed that the pupae were less and the larvae more susceptible than the adults to acrylonitrile, carbon bisulphide, chloropicrin, ethylene dibromide, hydrogen cyanide and methyl bromide. The eggs appeared to be relatively susceptible to acrylonitrile, ethylene dibromide and HCN, resistant to carbon bisulphide and relatively resistant to methyl bromide. Ethylene dichloride was much less effective than the other fumigants, and its LD95's were not found, being more than 270 mg. per litre for all stages.

The ratios of the dosages required to kill 95 per cent. of the least and most resistant stages were 1:3, 1:3.6, 1:1.7, 1:5.6, 1:7.7 and 1:2.2, for acrylonitrile, carbon bisulphide, chloropicrin, ethylene dibromide, hydrocyanic acid and methyl bromide, respectively, and published toxicity data indicate that some of these ratios are greater than those between adults of other stored-product pests. At the LD95, acrylonitrile and ethylene dibromide were the most toxic to all stages of *C. oryzae*, followed by HCN, methyl bromide and chloropicrin; carbon bisulphide and ethylene dichloride were the least toxic.

HANNA (R.L.). **Insecticidal Seed Treatments for Cotton.**—*J. econ. Ent.* **51** no. 2 pp. 160–163. Menasha, Wis., 1958.

Tests were carried out at College Station, Texas, in 1954–56 to evaluate insecticide treatments of cotton seed for the control of early-season pests; of these, only *Frankliniella fusca* (Hinds) and *F. tritici* (Fitch) occurred in numbers sufficient for the results to be reliable. Dust formulations were applied to mechanically delinted seed, which was sown within a week at about 32 lb. per acre, and demeton [diethyl 2-(ethylthio)ethyl phosphorothioate], Am. Cyanamid 12008 [O,O-diethyl S-isopropylthiomethyl phosphorodithioate] and Am. Cyanamid 12009 [O,O-diethyl S-propylthiomethyl phosphorodithioate] at 1 lb. per bushel in 1954, Thimet [O,O-diethyl S-ethylthiomethyl phosphorodithioate] at 0.5 and 1 lb. and 12008 and demeton at 1 lb. per acre in 1955, and Thimet at 0.92 lb. and Bayer 19639 [O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate] at 0.93 and 1.88 lb.

per acre in 1956 all controlled the thrips almost completely for 4–5 weeks from the date of sowing and gave partial control for another fortnight. In 1956, 1.06 lb. Thimet per acre gave similar protection of acid-delinted seed sown at about 25 lb. per acre, seed treatment with aldrin at 0.47 lb. per acre and applications of 0.49 or 1.07 lb. heptachlor per acre in granules in the furrows caused some reduction in thrips, and three foliage sprays affording a total of 3.8 lb. toxaphene per acre gave low reductions at first but were more effective later than seed treatment with systemic insecticides. In 1955, three applications of a toxaphene spray were less effective than the seed treatments. The systemic materials varied in phytotoxicity, which was manifested by reduced emergence or somewhat delayed fruiting under unfavourable conditions for plant emergence and growth, but none caused significant reductions in yield.

CHARPENTIER (L.J.). **Recent Attempts to establish Sugarcane Borer Parasites in Louisiana.** — *J. econ. Ent.* **51** no. 2 pp. 163–164, 2 refs. Menasha, Wis., 1958.

In further investigations on the control of *Diatraea saccharalis* (F.) on sugar-cane in Louisiana by the introduced parasites. *Metagonistylum minense* Tns. and *Lixophaga diatraeae* (Tns.) [*cf. R.A.E.*, A 45 195–196], 1,043 and 24,705 adults of these two Tachinids, respectively, were released on 19 plantations in 1955 and 2,622 and 24,411 on 15 plantations in 1956. Surveys of release areas in the autumn resulted in no recoveries of *M. minense*, but there were averages of 19 per cent. parasitism by *L. diatraeae* in 1955 and 33 per cent. in 1956, and the parasite became established in fields 1.5-2 miles from release points. *M. minense* was found to have survived a minimum temperature of 23°F. in appreciable numbers in fields of unharvested cane, but was present in cane trash left in the fields after harvest in only one plantation by December 1956. The four Braconid parasites introduced from India [45 196] were again released in 1955, but no recoveries were made. *Agathis stigmatera* (Cress.), introduced from Florida, was recovered in 1956 in an area in which 68 adults had been released in 1944.

SALKELD (E.H.) & SCOTT (H.E.). **Tests of Insecticides and application Methods against the Carrot Rust Fly in the Peat-muck Soil of the Holland Marsh, Ontario, 1949–1954.** — *J. econ. Ent.* **51** no. 2 pp. 165–168, 13 refs. Menasha, Wis., 1958.

Carrots are extensively grown in the Holland Marsh area of Ontario and are infested by *Psila rosae* (F.) [*cf. R.A.E.*, A 46 316]. Investigations on control were carried out in 1947–54, and as any carrots damaged by the larvae are unsaleable, only treatments that reduced the numbers of damaged roots by at least 60 per cent. were considered satisfactory.

Applied in 100 U.S. gal. spray per acre to the foliage, the top of the root and 2-3 inches of soil on each side of the furrow when the adults first appeared and again ten days later, 2 lb. wettable chlordane, aldrin or dieldrin, 1 lb. wettable lindane [almost pure γ BHC] or parathion, and 2 lb. chlordane in an emulsion spray all gave satisfactory control of moderate or severe infestations on early carrots in 1949–51, whereas 2 lb. DDT in emulsion spray did not. Applications of 2 lb. emulsive parathion, aldrin or chlordane or wettable dieldrin or γ BHC per acre in 50 U.S. gal. weed-killer in June 1951, when the plants had 2–4 leaves and were heavily

infested, gave at least 75 per cent. control, but scorched the foliage and reduced the yields; plants sprayed with weed-killer only were not injured. Experiments on soil and seed treatments and foliage dusts gave inconclusive results, owing to low infestation.

Disking insecticides into the soil to a depth of 3—4 in. before sowing, at the rate of 6 lb. per acre unless otherwise stated, gave the best control on late carrots; although wettable-powder sprays of aldrin, dieldrin, heptachlor, chlordane, parathion (at 3 lb.) or γ BHC (at 2 lb.) did not give satisfactory control of a heavy infestation in 1951, the same materials, with γ BHC again at 2 lb., in dusts, aldrin, heptachlor or chlordane in granules and aldrin or chlordane in emulsion concentrates gave excellent results in 1952—54; 6 lb. malathion and 0.6 lb. γ BHC in dusts were ineffective. Only parathion gave satisfactory control when applied to the seed or sprayed on to the foliage of late carrots, but it is not recommended, because of the danger to the operator. Applications of aldrin, heptachlor or chlordane in granules to the seed furrow and of various dusts to the foliage were ineffective.

On carrots that were sown in May but not harvested until autumn, only treatment of the soil before sowing was effective; in 1952, applications of 2 lb. γ BHC or 6 lb. heptachlor, parathion, chlordane, aldrin or dieldrin in dusts gave at least 90 per cent. control of a 50 per cent. infestation at the end of September, and in 1953, applications of 6 lb. chlordane, aldrin or heptachlor in granules gave at least 70 per cent. control of a severe infestation in October. Seed and furrow treatments and sprays or dusts applied to the foliage gave very poor control of autumn infestation.

Incorporating highly persistent insecticides into the soil to kill the larvae as they moved to the roots made it unnecessary to apply measures against the adults and was the most effective of the methods tested. The amounts necessary were much higher in the peat-muck soil of Holland Marsh than would be required in inorganic soils, but no phytotoxic effects were observed.

O'BRIEN (R.D.) & FISHER (R.W.). **The Relation between Ionization and Toxicity to Insects for some neuropharmacological Compounds.**—*J. econ. Ent.* **51** no. 2 pp. 169—175, 24 refs. Menasha, Wis., 1958.

The following is based on the authors' abstract. In order to study the rôle of ionisation in the toxicity of neural poisons to insects, the authors examined the toxicity of 35 neuropharmacological agents to *Musca domestica* L., *Periplaneta americana* (L.), *Oncopeltus fasciatus* (Dall.), *Anasa tristis* (Deg.), *Macrosiphum pisum* (Harris) and mice. Comparison of the observed ratios of mammalian to insect toxicity with those calculated on the hypothesis that the whole compound is effective in the mouse, but only the non-ionised fraction in the insects, confirmed this assumption for nitrogenous anticholinesterases and showed clearly that convulsants are intrinsically ineffective against insects. With other agents, the factors are more complex.

WILSON (J.W.) & VAN MIDDELEM (C.H.). **Residues resulting from Applications of Demeton to Cabbage and Celery.**—*J. econ. Ent.* **51** no. 2 pp. 175—178, 6 refs. Menasha, Wis., 1958.

An emulsion concentrate containing 2 lb. demeton [diethyl 2-(ethylthio)-ethyl phosphorothioate] per U.S. gal. was applied at transplanting time

or later in irrigation water to cabbage during three growing seasons and to celery during two at Sanford, Florida. Small populations of aphids developed on the untreated plots in the 1954–55 and 1955–56 seasons, but were too low to permit evaluation of the different doses of demeton. When the insecticide was applied in about 1,100 U.S. gal. water per acre to newly transplanted cabbage seedlings, treatment with 0.5-1.25 lb. actual demeton per acre resulted in residues at harvest below the tolerance (0.75 part per million) after 79 days in 1953–54 but above it after 70 days in 1954–55. However, treatment with 0.75, 1 or 1.25 lb. per acre in 1955–56 resulted in residues of less than the tolerance 66 days or more later. Celery treated in a similar manner with 1.25 lb. actual demeton in 1955–56 showed residues of 0.72 p.p.m. after 100 days; lower dosages left proportionately lower residues.

Foliage sprays were also tested, and, with one exception, demeton residues on both celery and cabbage plants that had been sprayed with 0.25 lb. actual compound in 90 U.S. gal spray per acre at 21-day intervals, beginning two weeks after transplanting, were less than 0.75 p.p.m. 21 days after the last application, but residues after shorter intervals or from higher doses exceeded the tolerance.

ROBERTSON jr. (R.S.) & KLOSTERMEYER (E.C.). **Aphid Populations on Field Beans in Washington.** — *J. econ. Ent.* **51** no. 2 pp. 178–181, 5 refs. Menasha, Wis., 1958.

The following is substantially the authors' abstract. Aphid surveys were made on dry or bush bean fields at Prosser, Washington, during the summers of 1954, 1955 and 1956, and resulted in the addition of 17 species to the list of the aphids of the Yakima Valley. Collections in yellow water-filled trap pans comprised an average of over 90 per cent. *Myzus persicae* (Sulz.), with population peaks at the end of July in 1955 and in mid-July in 1956. Collections from bean foliage showed higher proportions of *Macrosiphum avenae* (F.) (*granarium* (Kby.)) and *M. pisum* (Harris) and lower proportions of *Myzus persicae* than did the traps. More alates of *M. persicae* were found on the foliage of Red Mexican U.I.34 beans than on that of four other varieties. Aphids were unable to establish colonies on the beans, and usually only alate viviparae and a few young nymphs were found on the foliage, apparently because the insects were caught by the hooked hairs on the leaves and lived only a short while [*cf. R.A.E.*, A 42 44].

SHANDS (W.A.), THOMPSON (C.G.), SIMPSON (G.W.) & WAVE (H.E.). **Preliminary Studies of entomogenous Fungi for the Control of Potato-infesting Aphids in Maine.** — *J. econ. Ent.* **51** no. 2 pp. 184–186, 8 refs. Menasha, Wis., 1958.

Observations made since 1941 on fungi attacking aphids on potato in north-eastern Maine showed that *Macrosiphum solanifolii* (Ashm.) was more and *Aphis abbreviata* Patch less susceptible to infection than *Myzus persicae* (Sulz.) and *Macrosiphum* (*Myzus*) *solani* (Kalt.). *Entomophthora* (*Empusa*) *aphidis* was the predominant fungus, followed by *E.* (*E.*) *sphaerosperma*. An unidentified species of *Entomophthora* (*Empusa*) was unusually important in 1954–55, and *E. coronata* was isolated from a collection of *Myzus persicae, Macrosiphum solani* and *M. solanifolii* in 1947 and used to infect healthy examples of *Myzus persicae* in the greenhouse.

Preliminary field tests were made near Presque Isle in 1955, in which

suspensions of spores of the unidentified species of *Entomophthora* were applied to *Rosa rugosa* and *R. palustris*, artificially infested with *Macrosiphum solanifolii*, on 13th June, and spores of a species of *Acrostalagmus*, probably *A. aphidum*, obtained from Hawaii, to naturally infested *R. rugosa* on 22nd June and potato on 20th and 28th July and 5th August. No recoveries of *Entomophthora* were made, and aphids infected with *Acrostalagmus* were obtained only from the last treatment and not until three weeks after application. *M. solanifolii* was the only species found infected, and 60 per cent. of those killed by disease were infected with *Acrostalagmus* and the remainder with *Entomophthora* sp., *E. aphidis* or *E. sphaerosperma*. As two aphids infected with *Acrostalagmus* were found in an adjacent untreated plot, spread had evidently occurred. There was less than one example of *M. solanifolii* per three leaves when the fungus became established, indicating that large populations are not essential for successful results.

BERGER (R.S.) & RANDOLPH (N.M.). **The Determination of some Insecticidal Residues in Soils by Bioassay.** — *J. econ. Ent.* 51 no. 2 pp. 186–187. 10 refs. Menasha, Wis., 1958.

Since chemical determination of insecticide residues in soil does not necessarily indicate their toxicity, a bioassay method using larvae of *Aëdes aegypti* (L.) was tested in Texas in 1955 and 1956. Plots treated with 66.5 lb. DDT, 125.1 lb. toxaphene, 11.2 lb. dieldrin and 66.5 lb. BHC (25 per cent. γ isomer) per acre were available, and the residues were extracted with a mixture of hexane and acetone (4:1) from soil samples taken at depths of 0–3 and 3–6 in. and tested in acetone suspension. The results indicated that residues of the four compounds averaged 4.9, 7.8, 1.3 and 1.5 lb. per acre, respectively, in the top three inches and 6.6, 13.3, 1.2 and 1.1 lb. in the next three inches. Dieldrin was apparently the most stable with 22.3 per cent. recovery of the amount applied, and BHC the least, with less than 4 per cent.; approximately 17 per cent. of the DDT and toxaphene was recovered. Significantly more toxaphene was found in the lower than in the upper layer; there were no significant differences for the other materials.

CONNIN (R.V.), GORZ (H.J.) & GARDNER (C.O.). **Greenhouse Technique for evaluating Sweetclover Weevils' Preference for Seedling Sweetclover Plants.** — *J. econ. Ent.* 51 no. 2 pp. 190–193, 1 fig., 5 refs. Menasha, Wis., 1958.

In recent years, feeding by overwintered adults of *Sitona cylindricollis* Fhs. on emerging plants of sweet clover (*Melilotus*) has made it difficult to establish and maintain stands in the United States and has caused a material reduction in the acreage grown. Since some varieties are apparently less injured than others by the feeding of the weevils [*cf. R.A.E.*, A 45 346], the selection of resistant varieties has been suggested, and the author describes investigations to develop a greenhouse technique for evaluating the preference of the adults for seedlings of different varieties of *M. alba*. Statistical analysis indicated that the most reliable results would be obtained with the use of five varieties per cage, replicated in two 5 x 5 Latin squares and infested with two weevils per plant. The weevils should be introduced when the plants have one trifoliate leaf and removed when the first of the standard susceptible control plants is

completely defoliated, after which the results should be recorded within one day. The use of self-pollinated seed from a single homozygous susceptible plant, maintained by vegetative cuttings, for the standard control will enable comparison of materials tested from cage to cage and from year to year.

RIEHL (L.A.), LADUE (J.P.) & RODRIGUEZ jr. (J.L.). **Evaluation of representative California Spray Oils against Citrus Red Mite and California Red Scale.**—*J. econ. Ent.* 51 no. 2 pp. 193–195, 8 refs. Menasha, Wis., 1958.

The following is largely based on the authors' abstract. Laboratory tests were carried out by a method based on one previously described [*R.A.E.*, A 42 149] to determine the LD95's of eight representative Californian highly refined light-medium and medium petroleum oils in emulsion sprays applied against eggs of *Panonychus citri* (McG.) and adult females of *Aonidiella aurantii* (Mask.) on *Citrus*. There were differences in the values obtained, but they showed no consistent correlation with the physical and chemical properties of the oils, two of which were highly paraffinic and the remainder highly naphthenic in character. It is concluded that the oils that gave the best results against the mite eggs were about twice as effective against these as against the female Coccids. The lethal effect on the eggs was associated with the highest-boiling portion of the oils, and five of the oils were more effective against the mite eggs and seven less effective against the Coccids than was expected from their average molecular weights [*cf.* 42 290].

STARKS (K.J.) & THURSTON (R.). **Chemical Control of Clover Leaf Weevil Larvae.**—*J. econ. Ent.* 51 no. 2 pp. 195–198. Menasha, Wis., 1958.

Larvae of *Hypera punctata* (F.) occur in fields of leguminous fodder plants in north-central Kentucky every spring, but are generally controlled by fungus disease. In 1956, they were of little importance in this region, but caused serious damage from about mid-March in the south-west of the State, where they had previously been almost unknown. There was an average of 40 larvae per sq. ft. in some stands of red clover [*Trifolium pratense*], and damage was so severe in these that they were ploughed under. Lucerne was damaged severely and ladino clover [*T. repens latum*] and *Lespedeza* slightly. Fewer than 1 per cent. of the larvae were attacked by fungi. Infestation was again heavy in March 1957, but frequent rain and high humidity in early April presumably favoured the fungus, and larval mortality reached 80 per cent. on untreated plants.

Insecticides were applied against the larvae in April 1956. In small-plot tests on red clover, significant mortality was given in two days by heptachlor at 0.25 lb. per acre in granules, but not by aldrin at 0.25 lb. or dieldrin at 0.125 lb., and by endrin and lindane [almost pure γ BHC] at 0.125 lb., heptachlor, aldrin and Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate] at 0.25 lb., malathion at 0.75 lb. and toxaphene at 1 lb. in 20 U.S. gal. emulsion spray per acre, but not by similar sprays containing diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] at 0.25 lb. or methoxy-DDT (methoxychlor) at 0.5 lb.; the highest mortality (50 per cent.) was given by the malathion spray. Mortality was rather less for all treatments after a week, but it was

then found that the heptachlor, aldrin and endrin sprays resulted in 50 per cent. or more moribund larvae, and these did little feeding in laboratory tests and seldom recovered. The heptachlor and aldrin sprays were the most effective in reducing feeding by larvae in the field, and the Chlorthion, malathion, toxaphene, γ BHC, endrin, aldrin, and heptachlor sprays in reducing the number of living larvae on and round the plants.

In a large-plot experiment in which emulsion sprays were applied to lucerne, the mortality percentages after two weeks and (in brackets) a month were 84 (89) for malathion at 12 oz. per acre, 87 (97) and 88 (98) for heptachlor at 4 and 6 oz., 89 (93) and 32 (91) for endrin at 2 and 3 oz., 76 (86) and 81 (94) for toxaphene at 16 and 24 oz. and 64 (90) and 82 (89) for γ BHC at 2 and 3 oz., respectively, as compared with 23 (42) for no treatment.

KIIGEMAGI (U.), MORRISON (H.E.), ROBERTS (J.E.) & BOLLEN (W.B.). **Biological and chemical Studies on the Decline of Soil Insecticides.** — *J. econ. Ent.* 51 no. 2 pp. 198–204, 3 graphs, 14 refs. Menasha, Wis., 1958.

Aldrin, dieldrin and heptachlor gave good control of *Scutigerella immaculata* (Newp.) in some field tests in Oregon in 1950–54, but not in others, and special studies were begun in 1954 on the factors responsible for the anomalous results. Aldrin, dieldrin and heptachlor were mixed at about five parts per million, with or without 5 p.p.m. urea as a stabiliser, with untreated and autoclaved samples of two different silt-loam soils, taken from areas in which *Scutigerella* control had and had not been successful. Their rates of decline over a period of 11 months were measured by a total-chlorine method and by bioassay with mosquito larvae. These showed a high initial recovery of the insecticides from the soil, followed by a rapid decline for all three compounds, which could not be associated with soil micro-organisms or with the physical or chemical properties of the soils, which were similar [cf. next abstract but one]. A specific phenylazide method for aldrin and dieldrin showed little change in insecticide content after 11 months; no explanation can be offered for the discrepancy between the specific and non-specific methods of analysis or for the difference in control of *Scutigerella*.

EBELING (W.) & PENCE (R.J.). **Laboratory Evaluation of Insecticide-treated Soils against the Western Subterranean Termite.** — *J. econ. Ent.* 51 no. 2 pp. 207–211, 3 figs., 5 refs. Menasha, Wis., 1958.

The following is based largely on the authors' abstract. Marked differences in the initial and subsequent performances of various insecticides added to soil for the control of termites [*cf. R.A.E.*, A 46 225, etc.] did not appear to be related to differences in the persistence of residues, and laboratory experiments were therefore made with *Reticulitermes hesperus* Banks to ascertain what other factors might be involved. The termites were confined on a thin layer of sand that had been treated with 0.01-4 g. insecticide per 100 ml. water, at a rate equivalent to 2 U.S. gal. per 10 sq. ft. of surface, and the times required for 50 per cent. immobility and 50 per cent. mortality were determined. There was least difference between these values for pentachlorophenol, sodium pentachlorophenate and sodium arsenite, mortality following relatively soon after immobility. Lindane [almost pure γ BHC] was the most effective in causing immobility at all

concentrations and pentachlorophenol in causing mortality at all but the lowest, at which it equalled γ BHC. Sodium arsenite, sodium pentachlorophenate and pentachlorophenol were the most, and γ BHC, dieldrin and chlordane the least, affected by successive dilution. When the concentration used was 1 per cent., the ratios of relative effectiveness of the insecticides were about the same 17 months after application to soil as immediately after application to fine sand, except in the case of sodium arsenite, which is a stomach poison; this was less effective in sand, which is not so readily ingested as soil.

When tested in the same way, the toxicity of the upper half inch of soil was greater than that of the next inch below for all insecticides but γ BHC. Emulsions were generally more adversely affected by passing through soil than were kerosene or water solutions, presumably because the emulsified droplets of insecticide and solvent were strained out from the dilute emulsion, and the emulsion containing DDT was the most adversely affected, probably because it was the most quick-breaking of those tested and was more adversely affected by dilution than those containing γ BHC, dieldrin or chlordane. Sodium pentachlorophenate was the most adversely affected among the solutions. Soil that had been treated 11 months before with emulsions containing 1 per cent. DDT, chlordane, dieldrin or γ BHC proved to be effective barriers against the usual upward movement of the termites when put on damp sand containing them in glass test-tubes. Dieldrin had a significant toxic effect on the termites below the treated barrier, presumably as a result of vapour action, but the others did not.

BOLLEN (W.B.), ROBERTS (J.E.) & MORRISON (H.E.). **Soil Properties and Factors influencing Aldrin-Dieldrin Recovery and Transformation.** — *J. econ. Ent.* **51** no. 2 pp. 214–219, 1 graph, 20 refs. Menasha, Wis., 1958.

The following is based on the authors' abstract. Variations in the toxic effect of aldrin and dieldrin in two different soils in Oregon [*cf.* preceding abstract but one] led to investigations on their persistence and possible chemical transformation under field conditions. After 21 months, nearly half the aldrin originally applied to the soils was lost, although a significant amount was recovered as dieldrin [*cf. R.A.E.*, A **47** 56]. There was less loss when dieldrin was used and no significant transformation to aldrin was detected. Microbial activity appeared to be unimportant in these changes. The amounts of aldrin and dieldrin recovered did not appear to be correlated with the buffer capacity, ammonium-binding power, cation exchange capacity, mechanical analysis, moisture tension, pH or chemical analyses of the soils. No single soil property appeared responsible for variations in effectiveness of the two insecticides, but three properties that differed sufficiently in the two soils to indicate that they might be concerned were their cation exchange capacities and their calcium and magnesium contents.

The phenylazide method used to analyse extracts of 20-g. soil samples was sensitive to 0.2 part per million aldrin and 0.4 p.p.m. dieldrin. The method for extraction of aldrin needs additional investigation, the usual solvent, Skellysolve B, proving excellent for free aldrin, but less effective for aldrin in soil. Successive extractions gave higher recovery than a single one, and the dieldrin solvent, Skellysolve B with the addition of 25 per cent. acetone, greater recovery of aldrin from soil with a single extraction. It appears that none of the methods used in these and previous studies gives a complete picture of what happens to aldrin and dieldrin on contact with the soil.

WILSON (M.C.) & DAVIS (R.L.). **Development of an Alfalfa having Resistance to the Meadow Spittlebug.** — *J. econ. Ent.* 51 no. 2 pp. 219–222, 5 refs. Menasha, Wis., 1958.

Numerous tests in two-acre fields throughout Indiana in 1956 of a strain (A600) of lucerne synthesised for desirable agronomic qualities and resistance to insects [*cf. R.A.E.*, 41 353] from four parent clones, of which three had resistance to *Philaenus leucophthalmus* (L.) and all four resistance to *Empoasca fabae* (Harris), showed that it had inherited the resistance to *Philaenus* from its parent. This resistance appeared to include antibiosis (from a parent that had consistently supported much lower populations than other clones in survival and field-population studies), tolerance, probably the most important resistance factor, since damage from infestation is generally slight, and unattractiveness, or non-preference, of which there has been some evidence in selected lucerne, though it is more difficult to ascertain.

LICHTENSTEIN (E.P.) & MEDLER (J.T.). **Persistence of Aldrin and Heptachlor Residues on Alfalfa.** — *J. econ. Ent.* 51 no. 2 pp. 222–226, 2 graphs, 11 refs. Menasha, Wis., 1958.

As heptachlor and aldrin are suitable for the control of grasshoppers and Mirids on lucerne [*cf. R.A.E.*, A 45 22], they were applied in Wisconsin at about 2.5 and 5 oz. in 10 U.S. gal. emulsion spray per acre to ten-inch plants on 31st July 1956, to determine the rate of disappearance of their residues under local conditions. Samples were collected immediately and at intervals for up to 21 days after treatment and the residues evaluated by specific chemical methods and by a bioassay method involving direct feeding of *Drosophila melanogaster* Mg. exposed to the lucerne. After seven days, chemical analysis showed residues of 0.1 part per million or less, but bioassay revealed slightly more heptachlor and 3.5–7.6 times as much aldrin. The difference between the aldrin residues indicated by bioassay and by chemical analysis increased with the time after treatment, probably indicating conversion of this compound to another toxicant that was not revealed chemically [*cf.* 47 56–57]. No heptachlor was found by either method two weeks after treatment, and no aldrin three weeks after it.

MADSEN (H.F.) & BAILEY (J.B.). **Biology and Control of the Leaf Curl Plum Aphid in northern California.** — *J. econ. Ent.* 51 no. 2 pp. 226–229, 1 fig., 6 refs. Menasha, Wis., 1958.

Anuraphis (*Aphis*) *helichrysi* (Kalt.)* was observed curling the leaves

* In Opinions 397 and 563, the International Commission on Zoological Nomenclature has enjoined the use of the names *Aphis pruni* Geoffr. and *A. padi* L. for species to which they would not apply under strict application of the rules. As a result, the mealy plum aphis is *Hyalopterus pruni* (Geoffr.) [*cf. R.A.E.*, A 44 102 (note)] and the European bird-cherry aphis (which migrates from *Prunus padus* to cereals and grasses and has been cited in this *Review* as *Rhopalosiphum prunifoliae* (Fitch)) is *R. padi*. This decision leaves the name *Anuraphis helichrysi* (Kalt.) for the leaf-curling plum aphis previously cited as *A. padi*, but gives no evidence whether *R. prunifoliae* is identical with *R. padi* or is a closely allied American species. — *Ed.*

of plum in Placer County, in the foothill district of northern California, in 1952, and observations on its bionomics and control were made in 1954–57. The preliminary results have already been noticed [*R.A.E.*, A 45 153]. The further work on its bionomics indicated that the winter eggs hatch in late March, during the bloom or petal-fall stage of plums in the foothill area, and that all the aphids have left the trees for their summer food-plants by the end of June. Some varieties of plum were preferred to others and two of the more important appeared to be free from attack. Both plum and prune are infested in the upper Sacramento Valley.

Large-scale plot tests in 1955 confirmed that dormant and delayed-dormant sprays gave good control, but there were reports of injury to some varieties of plum by winter applications of dinitrophenol in oil emulsion. In tests of phosphorus insecticides applied to the foliage in emulsion sprays on 16th May 1956, 2 pints 48 per cent. Thimet [O,O-diethyl S-ethylthiomethyl phosphorodithioate] per 100 gal. gave complete control, but 2 pints 25 per cent. diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] and 1 pint 50 per cent. Trithion [O,O-diethyl S-p-chlorophenylthiomethyl phosphorodithioate] per 100 gal. were unsatisfactory, though diazinon gave a good initial reduction. In 1957, delayed-dormant applications in early February of 3 U.S. gal. 10 per cent. Phostex [a mixture of bis(dialkyloxyphosphinothioyl)disulphides] or 5 per cent. Nialate [O,O,O',O'-tetraethyl S,S'-methylene bisphosphorodithioate (ethion)] in miscible oil or of mixtures of 3 U.S. pints 48 per cent. Trithion or 6 lb. 25 per cent. parathion with 6 U.S. gal. dormant oil per acre all destroyed the overwintering eggs. It is concluded that sprays directed against these give the most effective control and that a delayed-dormant application of phosphorus compound in oil may be substituted for a dormant spray of dinitrophenol in oil on sensitive varieties of plum.

JEPPSON (L.R.), JESSER (M.J.) & COMPLIN (J.O.). **Resistance of the Citrus Red Mite to organic Phosphates in California.**—*J. econ. Ent.* 51 no. 2 pp. 232–233. Menasha, Wis., 1958.

Field observations in 1954 indicated that *Panonychus citri* (McG.) had developed resistance in the Corona district of California to ovex [p-chlorophenyl p-chlorobenzenesulphonate] applied to *Citrus* for its control. In investigations in one lemon grove in which parathion was applied once each year from 1951 to 1957 for the control of *Aonidiella aurantii* (Mask.), demeton [diethyl 2-(ethylthio)ethyl phosphorothioate] was tested against the mite from April 1954 when the resistance to ovex became apparent. Treatments were applied as soon as the population reached 10 per sample of 32 leaves. Demeton was applied in sprays at 10–20 oz. per acre and became ineffective after the second application when alternated with an ovex spray and after the fourth when used in all applications; there was some reduction in effectiveness after the second application when it was alternated with Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite], but the mite was evidently less resistant in these plots. Laboratory investigations indicated that mites in plots receiving the annual parathion treatment but no demeton were resistant to the latter by 1957, probably because resistant mites had migrated to them.

Laboratory tests with non-resistant mites from an abandoned orange grove and resistant ones from an orange grove that had been treated five times with a mixture of demeton and parathion showed that the concentration of Trithion [O,O-diethyl S-p-chlorophenylthiomethyl phosphorodithioate] necessary for 95 per cent. mortality was 30,000 times as great for the

resistant as for the non-resistant mites, those of Isosystox (O,O-diethyl S-2-(ethylthio)ethyl phosphorothioate [demeton-S]), methyl-demeton [dimethyl 2-(ethylthio)ethyl phosphorothioate], parathion and EPN [O-ethyl O-p-nitrophenyl phenylphosphonothioate], 1,600—4,000 times as great and those of Bio 1240 [O,O,O',O'-tetraethyl S,S'-methylene bisphosphorodithioate (ethion)] (here referred to as bis S-(diethoxyphosphinothioyl) mercapto methane) and malathion 6—9 times as great; the ratios for eight other compounds, including demeton, lay between 18 and 700.

SHERMAN (M.). **Latent Toxicity in the Mediterranean Fruit Fly and the Melon Fly.**—*J. econ. Ent.* 51 no. 2 pp. 234—236, 5 refs. Menasha, Wis., 1958.

Experiments were carried out in Hawaii to determine whether insecticides other than chlorinated hydrocarbons have the delayed effect termed latent toxicity, and the susceptibility of two other fruit-flies to it [*cf. R.A.E.*, A 44 56]. Full-grown third-instar larvae of *Ceratitis capitata* (Wied.) were allowed to pupate in sand that had been treated with an acetone solution of insecticide, dried, and then moistened with water; the pupae were removed seven days later to untreated sand in jars containing sugar and water as food for the adults, and the numbers of dead, moribund and living adults were recorded three days after emergence began. Direct toxicity was determined from the numbers of insects killed prior to completion of the pupal stage and of adults that failed to emerge or were abnormal, latent toxicity from those that died within three days after emergence and total toxicity from the sum of these, as compared with the total of living and dead insects. The LD50's for direct and total toxicity were estimated from graphs, and the differences between them gave the LD50's for latent toxicity, which proved to be statistically significant for aldrin, dieldrin, chlordane, endrin, isodrin, lindane [almost pure γ BHC] and Strobane [a chlorinated mixture of α-pinene isomers with a chlorine content of about 66 per cent.], but not for Dilan [a 1:2 mixture of 1,1-di(p-chlorophenyl)-2-nitropropane and 1,1-di(p-chlorophenyl)-2-nitrobutane], malathion, parathion, nicotine, Pyrenone (a mixture of pyrethrins and a synergist), Pyrolan [1-phenyl-3-methyl-5-pyrazolyl-dimethylcarbamate] or isobornyl thiocyanoacetate, the last of which showed little toxicity to the larvae.

In similar tests with *Dacus cucurbitae* Coq., aldrin, dieldrin, chlordane, endrin and isodrin showed latent toxicity, but less than against *C. capitata*, whereas γ BHC, malathion and parathion did not, and it is concluded that species, chemical structure and latent toxicity are definitely interrelated, and that there would be little or no latent mortality in species in which there is little difference in resistance between the immature and adult stages.

BOTTGER (G.T.), CHAPMAN (A.J.), MCGARR (R.L.) & RICHMOND (C.A.). **Laboratory and Field Tests with Sevin against Cotton Insects.**—*J. econ. Ent.* 51 no. 2 pp. 236—239, 1 fig. Menasha, Wis., 1958.

In laboratory tests made at Brownsville, Texas, in 1956, to compare Sevin [1-naphthyl N-methylcarbamate] with other materials for the control of arthropod pests of cotton, potted plants were sprayed with various concentrations of insecticide in emulsion form and then caged with insects, usually within an hour. Mortality counts made 48 hours later were used to calculate the LD50's, which were 0.58 and 0.43 lb. per acre for Sevin (as

compared with 0.68 and 0.25 lb. for DDT) against *Platyedra* (*Pectinophora*) *gossypiella* (Saund.) and *Heliothis zea* (Boddie), respectively, 0.94 and 0.96 lb. for Sevin (as compared with 0.2 and 0.25 for endrin) against *Trichoplusia ni* (Hb.) and *Estigmene acraea* (Dru.), and 0.6 lb. for Sevin against *Alabama argillacea* (Hb.). The LD50's against *Anthonomus grandis* Boh. after 22 hours were 0.26 lb. for Sevin and 0.07 lb. for dieldrin, but 0.25 lb. Sevin gave 97 per cent. mortality after 48 hours, indicating that this compound is somewhat slower in action than dieldrin. In single tests of acetone sprays applied to infested seedlings, 0.0015 per cent. Sevin was slightly less effective than 0.125 per cent. schradan against *Aphis gossypii* Glov., and 1 per cent. Sevin gave more rapid kill of *Tetranychus telarius* (L.) than the schradan spray. No phytotoxicity was observed. The persistent effect of Sevin was about equal to that of dieldrin, the period of effectiveness being 3—4 days. The results of these and other laboratory tests showed that Sevin compared favourably with the insecticides now recommended for the control of *Anthonomus grandis*, *P. gossypiella*, *H. zea* and *T. ni*, was effective against *E. acraea* at 2 lb. and against *Alabama* at 1 lb. per acre, and may have enough toxicity to the aphid and mite to prevent the development of damaging populations of them when it is used against other pests.

In a small-plot test in the Lower Rio Grande Valley, in which 11 applications of 22 lb. dust per acre were made at intervals of 4—5 days between 28th June and 10th August, 5—10 per cent. Sevin compared favourably with mixtures of 5 per cent. DDT with 3 per cent. Guthion [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate] and of 10 per cent. DDT with 2.5 per cent. dieldrin and 40 per cent. sulphur against *Anthonomus*, *Heliothis*, *Platyedra*, aphids and mites and in increasing yields, but 2.5 per cent. Sevin was relatively ineffective. In large-plot tests, 10—12 applications of 10 per cent. Sevin dust at intervals of 4—7 days gave good control of *Platyedra* and *Anthonomus* and excellent increases in yield.

SULLIVAN (W.N.), DU CHANOIS (F.R.) & HAYDEN (D.L.). **Insect Survival in Jet Aircraft.** — *J. econ. Ent.* 51 no. 2 pp. 239—241, 1 fig., 1 ref. Menasha, Wis., 1958.

The following is based on the authors' abstract. To find out if insects can survive the low temperatures, reduced pressure and low humidity in the stratosphere where jet aircraft operate, several species, including *Tribolium confusum* Duv., *Musca domestica* L., mosquitos and cockroaches, were exposed in wire-screen cages in the unpressurised and essentially unheated sections of jet fighters and bombers during flights. High mortality resulted in 45— to 55—minute high-level flights of jet fighters, except in the radar compartment, where heat from electronic equipment gave protection. In a jet bomber, all the insects were killed on a three-hour flight at 40,000 ft. (outside air temperature −51° C.) and on two of three flights of 2—2½ hours at 35,000—40,000 ft. Shorter flights at that altitude or long flights at low altitudes gave reduced kills.

SCHREAD (J.C.). **Thimet Soil Treatments for the Control of Leaf Miners.** — *J. econ. Ent.* 51 no. 2 pp. 245—246, 3 refs. Menasha, Wis., 1958.

Tests were made in Connecticut in 1957 on the control of *Fenusa pusilla* (Lep.) on grey birch [*Betula populifolia*], *Phytomyza ilicicola* Lw. (*ilicis*, *auct.*) on American holly [*Ilex opaca*] and *Monarthropalpus buxi* (Lab.) on box [*Buxus*] by means of granules containing 2 per cent. Thimet [O,O-diethyl

S-ethylthiomethyl phosphorodithioate], applied to the soil beneath the plants.

Applications to the whole area of hard, packed clay soil under clumps of birch on 12th April at 22 or 40 lb. Thimet per acre gave excellent control of the first and second generations of *Fenusa*, but similar applications of 2.5—20 lb. on 4th June were less effective against the second generation, giving only 15—36.2 per cent. kill and permitting many larvae to complete their development and give rise to normal adults. The soil was not watered at the time of application, but one irrigation was applied on 19th June, because of drought.

Adults of *Phytomyza* emerged and oviposited mostly between 21st and 28th May. Thimet granules were applied as a side dressing to holly plants 1—2 ft. high in nursery rows and raked into the soil on 10th July, or sifted over the soil to the periphery under trees 6—8 ft. high and thoroughly drenched with water on 19th July, and counts taken on 25th—30th September showed that doses of 1—2 oz. Thimet per plant for the small ones and of 4—16 oz. for the large ones gave excellent control.

Sifting granules over the soil under 3—ft. box plants with circumferences of 5—6 ft. on 18th July followed by soaking with water at this time and at approximately weekly intervals until early September, gave practically complete kills of larvae of *M. buxi* at doses of 0.08—0.32 oz. Thimet per plant. Applications of 0.005—0.01 oz. Thimet per plant on 9th August to a hedge 12—18 in. high and 12 in. wide at the top were less effective, causing 57—81 per cent. mortality by the beginning of October.

BRETT (C.H.). **Japanese Beetles: Differences in Damage to Varieties of Sweet Corn and Control with DDT.** — *J. econ. Ent.* 51 no. 2 p. 247, 2 refs. Menasha, Wis., 1958.

Adults of the Japanese beetle [*Popillia japonica* Newm.] were unusually abundant during the silking period of sweet maize at Faison, North Carolina, in 1957, and sprays prepared by diluting 5 gal. 25 per cent. DDT emulsion concentrate in 100 gal. water were applied at 25 U.S. gal. per acre for their control. Applications were directed into the silks and made three times at four-day intervals, beginning two days after the first silks appeared. Counts of the numbers of beetles per 100 silks about two weeks after the appearance of the latter showed 4, 0 and 1 on treated and 7, 14 and 208 on untreated plants of three varieties, respectively. The silks were almost entirely destroyed and kernel development much reduced on untreated plants of the last variety. The results indicate that DDT sprays give good control of *P. japonica* and that the silks are much more attractive to the beetle in some varieties than in others.

FLANDERS (S.E.). ***Moranila californica* as a usurped Parasite of *Saissetia oleae*.** — *J. econ. Ent.* 51 no. 2 pp. 247—248, 5 refs. Menasha, Wis., 1958.

Before the introduction of *Scutellista cyanea* Motsch. in 1902, *Moranila* (*Tomocera*) *californica* (How.) was a frequent parasite of *Saissetia oleae* (Bern.) in California and had no competitors of importance. It has since decreased in frequency and is now rare, having apparently been replaced by *Scutellista*. The two parasites have similar life-histories, the egg stage, three larval instars and pupal stage lasting 3, 4, 2, 8 and 12 days, respectively, at 82° F., but whereas *Scutellista* inserts its ovipositor through the

posterior arch of *Saissetia, Moranila* probes at any point round the periphery of the scale, making many unsuccessful attempts to oviposit, which may indicate that *S. oleae* is not a natural host. *M. californica* is bisexual, but reproduces parthenogenetically in the laboratory.

MALLIS (A.), MILLER (A.C.) & HILL (R.C.). **Feeding of four Species of Fabric Pests on natural and synthetic Textiles.** — *J. econ. Ent.* **51** no. 2 pp. 248–249, 8 refs. Menasha, Wis., 1958.

Tests in which fabrics made of various synthetic or natural fibres and of mixtures of wool with three synthetic materials were exposed to hungry larvae of *Tineola bisselliella* (Humm.), *Attagenus megatoma* (F.) (*piceus* (01.)) and *Anthrenus flavipes* Lec. and adults of *Thermobia domestica* (Pack.) for two weeks at temperatures of 80–84° F. and 40 per cent. average relative humidity showed that *Anthrenus* and *Thermobia* caused extensive damage to acetate and viscose rayon, respectively, and *Anthrenus* and *Attagenus* slight damage to nylon, but that there was no other appreciable damage to these or to Dynel, Dacron, Orlon or Vicara. *Thermobia* caused slight damage to silk and linen, but practically none to wool or the mixtures containing it, and the other three species caused extensive damage to wool and mixtures of wool with nylon, Orlon or viscose rayon. No other appreciable damage was recorded, except slight feeding on silk by *Attagenus*.

MILLER (A.C.), MALLIS (A.) & EASTERLIN (W.C.). **Oil-base Sprays against Larvae of the Black Carpet Beetle.** — *J. econ. Ent.* **51** no. 2 pp. 249–250, 2 refs. Menasha, Wis., 1958.

In the tests recorded, 12 insecticides were dissolved in a typical odourless base oil used for domestic sprays, with the aid of an auxiliary solvent when necessary, and applied directly to larvae of *Attagenus megatoma* (F.) *piceus*(01.)) at doses similar to those normally used in houses, by a method developed for other household insects [*R.A.E.*, B 42 185–186]. Observations made 1–28 days after treatment showed that 6 per cent. DDT, methoxy-DDT (methoxychlor) or Perthane [1,1-di(p-ethylphenyl)-2,2-dichloroethane (ethyl-DDD)], 3 per cent. malathion, 0.5 per cent. lindane [almost pure γ BHC] or diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate], 0.136 per cent. pyrethrins, and 0.128 per cent. each of pyrethrins and piperonyl butoxide affected the larvae more rapidly than 0.5 per cent. dieldrin, 2 per cent. chlordane or 2.5 per cent. Strobane [a chlorinated mixture of α–pinene isomers with a chlorine content of about 66 per cent.], and that DDT, malathion, diazinon and methoxy-DDT caused the greatest average proportions of moribund and dead larvae after 28 days. Practically no larvae survived treatment with DDT or malathion. Those unaffected by the other sprays after 28 days were transferred to woollen cloth. Few of those that had been treated with chlordane fed, but all the others did so.

WENE (G.P.). **Control of *Nysius raphanus* Howard attacking Vegetables.** — *J. econ. Ent.* **51** no. 2 pp. 250–251, 1 ref. Menasha, Wis., 1958.

Nysius raphanus How. was observed feeding on vegetable crops in the Lower Rio Grande Valley in February 1952 and reappeared on them in damaging numbers in the same month in 1954 and 1956, when drought caused

the Lygaeids to migrate from dying vegetation in uncultivated fields to the more succulent plants in irrigated ones. Severe infestation, reaching 70 insects per sq. in., destroyed fields of lettuce in 4—5 days, and large numbers also occurred on turnip, killing parts of the leaves by their feeding, and on cabbage, to which they caused no apparent damage; however, infested cabbage was rendered unsaleable by the presence of the insects on the outer leaves.

In tests in 1954 and 1956 in which dusts were applied at 25 lb. per acre, 2 per cent. endrin gave the best results on turnip and remained effective for at least seven days, whereas 5 per cent. heptachlor, 2.5 per cent. aldrin and 20 per cent. toxaphene were decreasing in effect by the 6th—7th day, and 0.1 per cent. impregnated pyrethrins and 5 per cent. malathion were effective on lettuce for at least 3—4 days, whereas sulphur dust and a mixture of 0.9 per cent. piperonyl butoxide and 0.06 pyrethrins gave inadequate control. In sprays applied to lettuce at 5 U.S. gal. per acre, 0.38 lb. dieldrin, 1 lb. schradan and 0.25 lb. methyl-parathion, Phosdrin [dimethyl 2-methoxycarbonyl-1-methylvinyl phosphate], diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate], demeton [diethyl 2-(ethylthio)ethyl phosphorothioate] or Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate] per acre gave good control for at least 3—7 days; malathion was very effective at 1.25 lb. but less so at 0.6 lb. per acre and caused the dead insects to adhere tightly to the leaves, which proved objectionable to buyers.

HAY (C.J.). **Life History and Control of a Root Collar Borer (*Euzophera ostricolorella* Hulst) in Yellow-Poplar.** — *J. econ. Ent.* **51** no. 2 pp. 251—252, 4 refs. Menasha, Wis., 1958.

The Pyralid, *Euzophera ostricolorella* Hulst, which has been reported from the eastern United States from New York to Georgia, was found boring in the inner bark of *Liriodendron tulipifera* in October 1954 over a considerable area near Lamasco, in western Kentucky, where trees of all sizes, but chiefly those larger than 10 in. in diameter at breast height, were found to be dead or dying as a result. Attacks were also observed in western Tennessee, though no dying trees were found, and, rarely, in eastern Kentucky. The infestation had probably been increasing for at least four years, but it apparently decreased subsequently, as few borers or new attacks were found in the autumn of 1956.

The main flight of the adults apparently occurs in early spring; the larvae become full-fed in late summer or early autumn, and the pupae overwinter in the tunnels. There was evidence of partial autumn emergence in 1955, and larvae from eggs laid at this time were about half-grown by mid-April 1956. Almost all boring was begun within 2 ft. of the ground, and it was concentrated in an area extending from 2 in. below to 5 in. above the soil litter, indicating a preference for a moist habitat. The tunnels extended more or less vertically, were seldom more than 4 in. long and about 0.25 in. in diameter and occurred almost entirely in the phloem.

Heavily infested dead or dying trees were felled in the early summer of 1955 in one area, and examination of the stumps in the following spring showed the presence of full-fed larvae and pupae, but no small larvae such as occurred in living trees, indicating that stumps are not favoured as sites for oviposition. Since broods could complete development in the stumps, cutting did not greatly reduce the population. Attacks did not cause much loss of timber, as few occurred above stump height. No parasites were reared, but empty pupal cases of Hymenoptera and Diptera were

found in the tunnels. Treating the trunks to a height of 6 ft. just before adult emergence in April 1955 with an emulsion spray containing 0.5 per cent. γ BHC and 2 per cent. DDT did not prevent attack or reduce brood survival, but the same materials in oil solution applied in the following spring apparently prevented new attacks and killed the larvae in the tunnels.

OWEN (B.L.) & OWEN jr. (W.L.). **Collembola Damage to Seedling Cotton.** —*J. econ. Ent.* 51 no. 2 pp. 252–253, 1 fig., 1 ref. Menasha, Wis., 1958.

Entomobrya unostrigata Stach damaged the cotyledons of seedling cotton over a wide area of the southern High Plains of Texas and eastern New Mexico in 1955–57; the injury occurred from about 10th May to 15th June and was previously unknown. Injury was heaviest where cotton gin trash had been added to the soil in the previous autumn, but also occurred in fields with large amounts of plant residue from previous crops, mainly sorghum and lucerne. Large numbers of *E. unostrigata* were always accompanied by noticeable populations of Anthicids and Staphylinids in the surface litter and soil of injured fields, but laboratory tests showed that only the Collembola were responsible for the damage. The plant stand was not seriously reduced when seed had been sown at 1 bushel per acre, but was poor where lower rates had been used. *E. unostrigata* was also observed in lawns and invading houses in the summer of 1956 and in large numbers in fields of small grains in the early summer of 1957. It was found in Colorado in 1950 and in California and Utah in 1952 and has probably only recently been introduced into North America.

BRETT (C.H.), CAMPBELL (W.V.) & HABECK (D.E.). **Control of three Species of Cabbage Caterpillars with some new Insecticide Dusts.** —*J. econ. Ent.* 51 no. 2 pp. 254–255, 7 refs. Menasha, Wis., 1958.

Considerable difficulty in controlling Lepidopterous larvae attacking cabbage is commonly reported from the mountains near Fletcher, North Carolina, where the species usually found, in order of importance and frequency of occurrence, are *Trichoplusia ni* (Hb.), *Pieris rapae* (L.), *Evergestis rimosalis* (Gn.) and *Plutella maculipennis* (Curt.). Toxaphene, DDT, parathion, malathion, endrin and rotenone have been used for general control, but have occasionally been reported as ineffective against *T. ni*.

In a test in 1955, dusts were applied at 30 lb. per acre to small cabbages attacked by *Pieris rapae*, and examination for larval injury to new growth after a week showed that 20 per cent. toxaphene gave excellent control, 4 per cent. malathion or 10 per cent. DDT poor control and 5 per cent. methoxy-DDT (methoxychlor) or Perthane [1,1-di(p-ethylphenyl)2,2-dichloroethane (ethyl-DDD)] none. In 1957, only *T. ni* was abundant before the cabbage heads had formed, but *P. rapae* and *E. rimosalis* were present in unusual numbers about four weeks later. Dusts were applied into the tops of the plants at 30 lb. per acre on 4th July, just before the heads formed, and three weeks later, and examination a week after each treatment showed that 20 per cent. toxaphene was consistently the most effective material tested, giving 74–100 per cent. control in all tests; 2.5 per cent. Guthion [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate] gave good control of *T. ni* in the pre-heading treatment, but poor results when applied later, and 1.5 per cent. Phosdrin [dimethyl 2-methoxycarbonyl-1-methylvinyl phosphate] and 4 per cent. Thiodan [6,7,8,9,10,10-hexachloro-

1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide] poor to fair control, both being somewhat more effective after the earlier than after the later application. Sevin (1-naphthyl N-methylcarbamate) was not applied before heading and gave poor or no control of *T. ni* in the later test, but fair to good control of *P. rapae* and *E. rimosalis*. Guthion, Phosdrin and Thiodan gave very good or complete control of these two species. The fact that the larvae burrow progressively deeper into the heads probably accounts for the difficulty experienced by growers in obtaining control, especially when applications are made too late or too far apart.

CUTRIGHT (C.R.). **Reactions of different Populations of *Panonychus ulmi* (Koch) to various Phosphorus-based Acaricides.** — *J. econ. Ent.* **51** no. 2 p. 255, 1 ref. Menasha, Wis., 1958.

Demeton [diethyl 2-(ethylthio)ethyl phosphorothioate], which proved effective against a strain of *Panonychus ulmi* (Koch) that had become resistant to parathion on apple in northern Ohio in 1954 and 1955 [*cf.* *R.A.E.*, A **46** 260], continued to be effective in most orchards in the area in 1956 and 1957. However, two reports of failures were received in 1956 and one in 1957, in an orchard that was being treated with demeton against a parathion-resistant population for the first time. In experiments in this orchard, sprays of 4—8 oz. 21 per cent. demeton emulsion concentrate per 100 U.S. gal. applied on 9th and 17th July were relatively ineffective, as also was Trithion [O,O-diethyl S-p-chlorophenylthiomethyl phosphorodithioate], but an emulsion spray of 1 U.S. pint 25 per cent. Kelthane [1,1-di(p-chlorophenyl)-2,2,2-trichloroethanol] per 100 U.S. gal. rapidly reduced the mite to insignificant numbers.

It is concluded that there are at least two races of *P. ulmi* resistant to parathion in northern Ohio, one of which is not resistant to demeton, whereas the other is, or immediately becomes resistant. The experience of growers, who successfully controlled the mite with demeton for one season before resistance became apparent, indicates that there are also strains intermediate in resistance.

DOANE (C.C.). **The residual Toxicity of Insecticides to *Scolytus multistriatus*.** — *J. econ. Ent.* **51** no. 2 pp. 256—257, 2 refs. Menasha, Wis., 1958.

Elms in Connecticut are sprayed with DDT just before the buds break to protect them from feeding by adults of *Scolytus multistriatus* (Marsham) and infection with *Ceratocystis* (*Ceratostomella*) *ulmi*, the causal agent of Dutch elm disease, of which the Scolytid is one of the principal vectors. Protection is required until at least mid-July, and four insecticides were compared with DDT in tests of alternative materials, all in emulsion sprays. The sprays were applied to run-off before the leaf buds opened and the deposits allowed to weather for 4, 8, or 13 weeks, after which twigs were cut off and adults of *S. multistriatus* confined with them in the laboratory. Residues from sprays of 0.5—1 per cent. dieldrin gave at least as high mortality after 24 hours on each occasion as did those from 1—2 per cent. DDT, but were much less effective in preventing feeding, which was recorded after 48 hours. None of the other materials surpassed DDT in this, but 1 per cent. lindane [almost pure *γ* BHC] persisted well and was comparable with it; 0.25 per cent. dieldrin, 0.5 per cent. heptachlor or *γ* BHC and 0.5—1 per cent. malathion gave unsatisfactory tree protection and insect mortality.

CRESSMAN (A.W.). **Malathion and Parathion with Oil for Control of California Red Scale.** — *J. econ. Ent.* 51 no. 2 pp. 257—258, 4 refs. Menasha, Wis., 1958.

Two field experiments were carried out near Whittier, California, to compare the effects of selected concentrations of parathion and malathion in sprays of oil emulsion applied against *Aonidiella aurantii* (Mask.) and *Panonychus* (*Metatetranychus*) *citri* (McG.) on lemon [*cf. R.A.E.*, A 39 164; 45 103]. In the first, sprays of 1 U.S. gal. special light oil with 0.75 lb. 25 per cent. wettable parathion or 1.5 lb. 25 per cent. wettable malathion per 100 U.S. gal., applied to heavily infested trees on 29th April 1952, gave average mortalities of 96.3 and 88.8 per cent. of adult female scales two months later, the difference between them being significant, but showed no difference in effectiveness against the mite, though the period of control was rather short, and no phytotoxicity. In September, there were more scales on the plots receiving malathion than on those sprayed with parathion.

In the second test, sprays of 1.8 U.S. gal. light-medium oil with 0.5 lb. 25 per cent. parathion emulsion concentrate or 1 lb. 25 per cent. wettable malathion per 100 U.S. gal. were applied on 6th October 1954 and again on 11th November 1955, and counts on 30th August 1954, 20th August 1955 and 21st September 1956 showed 1.5, 1.2 and 1.1 adult female scales per fruit, respectively, for the parathion spray and 1.9, 2.5 and 6.8 for the malathion spray, the differences between materials being significant. Mite control was better than in the first experiment, with no difference between treatments, and leaf drop was moderate for both of them and no greater than that often following the use of oil along.

DITMAN (L.P.) & WILEY (R.C.). **The Effectiveness of several Insecticides for Control of Insects on Snap Beans.** — *J. econ. Ent.* 51 no. 2 pp. 258—259. Menasha, Wis., 1958.

In tests in Maryland in 1957, emulsion sprays containing various insecticides were applied at 25 U.S. gal. per acre to snap beans sown on 2nd July. The two systemic insecticides tested were Thimet [O,O-diethyl S-ethylthiomethyl phosphorodithioate], applied at 9 oz. per acre on 10th July and demeton [diethyl 2-(ethylthio)ethyl phosphorothioate], applied at 12 oz. on 24th July, and the other materials were parathion at 4 oz., diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate], Trithion [O,O-diethyl S-p-chlorophenylthiomethyl phosphorodithioate], Thiodan [6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide] and Dilan [a 1:2 mixture of 1,1-di(p-chlorophenyl-2-nitropropane and 1,1-di(p-chlorophenyl)-2-nitrobutane] at 8 oz. and malathion and Sevin (1-naphthyl N-methylcarbamate) at 1 lb. per acre, all applied on 24th July and 1st, 7th and 15th August. Neither of the systemic materials reduced injury by *Epilachna varivestis* Muls., but the others all gave considerable control. All materials reduced the numbers of *Empoasca fabae* (Harris), Dilan, Trithion, Thiodan and Sevin being particularly effective, but, owing to variations within treatments, none had a significant effect on the percentages of pods injured by *Heliothis zea* (Boddie) or other borers, or on yield, and none affected the flavour of the canned beans.

ADKISSON (P.L.). **Field Tests of Materials for Control of the Cotton Leafworm.** — *J. econ. Ent.* 51 no. 2 p. 259, 1 ref. Menasha, Wis., 1958.

Sporadic but widespread outbreaks of *Alabama argillacea* (Hb.) in autumn occur on cotton in south-eastern Missouri and cause serious losses unless control measures are applied. The toxicity of various new insecticides to the larvae was tested in September 1957, in order that every effective material might be used against unexpected attacks. Emulsion sprays were applied with a high-clearance sprayer at 2 U.S. gal. per acre, and it was found that 0.2 lb. endrin, 0.5 lb. malathion or AC—528 [2,3-p-dioxane S,S-bis(O,O-diethyl phosphorodithioate)], and 0.25 lb. Phosdrin [dimethyl 2-methoxycarbonyl-1-methylvinyl phosphate] per acre gave complete mortality in 48 hours and 0.25 lb. Guthion [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl phosphorodithioate], AC—528, or CP—7769 [hexaethyl ethylthiomethylidynetriphosphonate], referred to as ethylthiomethylidynetri(phosphonic acid diethyl ester), 0.5 lb. Sevin (1-naphthyl N-methylcarbamate) and 2 lb. toxaphene more than 87 per cent. AC—528 was slower in action than the other materials.

OWEN (B.L.) & HAYNES (L.J.). **A Device for rapid Application of Measured Volumes of Toxicants to individual Insects.** — *J. econ. Ent.* 51 no. 2 pp. 261—263, 2 figs., 7 refs. Menasha, Wis., 1958.

The authors describe and figure a strong micrometer-syringe device with a minimum of moving parts, that proved rapid and accurate for applying measured volumes of insecticide to individual insects.

LIENK (S.E.) & CHAPMAN (P.J.). **Effect of the Winter Temperatures of 1956—57 on the Survival Rate of European Red Mite Eggs.** — *J. econ. Ent.* 51 no. 2 p. 263, 1 ref. Menasha, Wis., 1958.

There was an abnormally low rate of hatch among winter eggs of *Panonychus ulmi* (Koch) on apple wood collected in early March 1957 near Geneva, New York. To ascertain whether this was due to unusually cold weather in January, samples of infested wood were collected on 9th—19th April from localities with a considerable range in minimum winter temperatures and the rates of hatching determined in the laboratory at 70—80° F. and 30 per cent. relative humidity. The percentages were 42.2, 41.6, 41.6 and 21.04 for localities with minimum temperatures on 15th January of −9, −15, −18 and −22° F. and 4.56, 4.86, 0.4, and 0.18 for those with corresponding temperatures of −26, −25, −28 and −34° F. It is concluded that eggs in this area can withstand the usual low winter temperatures of −5 to −10° F., but that temperatures of about −22° F. or less can be expected to kill many eggs. The unexpectedly high survival rate of 2.7 per cent. after exposure to −34° F. in one locality, where the average minimum temperature for 19 years had been −21.9° F., may indicate a local adaptation to lower winter temperatures.

GIBSON (W.W.) & PAINTER (R.H.). **Transportation by Aphids of the Wheat Curl Mite, *Aceria tulipae* (K.), a Vector of the Wheat Streak Mosaic Virus.** — *J. Kans. ent. Soc.* 30 no. 4 pp. 147—153, 6 refs. Manhattan, Kans., 1957.

The following is substantially the authors' summary. Observations in the

greenhouse in Kansas showed that wheat plants harbouring large populations of *Aceria tulipae* (Keifer) often become weakened and chlorotic. At this state, the mites swarm upwards and form masses comprising great numbers of individuals on the uppermost plant parts. Aphids were observed to move into these masses before taking flight, with the result that mites crawled on to their bodies and wings. Since the mites remained in place when the aphids flew away, it is suggested that this might be a means of mite dispersal in the field. In 16 experiments, a pot of mite- and aphid-infested wheat plants was placed in one corner of a cage and pots of uninfested wheat seedlings in the other three corners. When aphids were seen on the seedlings, the plants were pulled up and examined for mites. Of 44 pots of seedlings exposed in nine separate trials, aphids moved on to the wheat plants in 38 and carried mites on to the seedlings in 17 instances. *Toxoptera graminum* (Rond.) was the most successful in transporting the mites. Mites were carried 5 ft., which was the greatest dimension of the largest cage used. Although the transport of mites by winged aphids or other flying wheat-field insects may be only a minor means of dispersal, it may be of significance in placement of the mites directly on to volunteer wheat or other suitable food-plants. This would greatly increase the chances of survival of the mites, especially at a time when volunteer or other suitable food-plants were scarce.

GREENBANK (D.O.). **The Role of Climate and Dispersal in the Initiation of Outbreaks of the Spruce Budworm in New Brunswick. 11. The Role of Dispersal.** — *Canad. J. Zool.* **35** no. 3 pp. 385—403, 2 figs., 18 refs. Ottawa, 1957.

The following is based almost entirely on the author's summary of this second part of a paper on the influence of climate and dispersal in initiating outbreaks of *Choristoneura fumiferana* (Clem.) on balsam fir [*Abies balsamea*] in New Brunswick [*cf. R.A.E.*, A **46** 314]. In the first part, it was shown by analysis of the available weather data that the outbreaks of 1912 and 1949 developed after several consecutive dry summers, and support was given to the theory of climatic release, which explains the time and place of outbreaks on a climatic basis [**44** 113]. However, the recorded history of *C. fumiferana* also shows that high populations appeared in New Brunswick shortly after infestation had spread through Quebec, and this suggests that the New Brunswick outbreaks are a continuation of this spread. In the present part, consideration is given to the rôle of dispersal. Moth dispersal is a more effective agent of spread than larval dispersal. Moths can be transported by convectional and turbulent air currents for long distances [*cf.* **40** 300]. Catches in light-traps, used from 1949 to detect the incidence of moth movements, showed that large segments of a population may be transferred from one area to another, and unspent females were often found to predominate in these movements. Moth invasion was detected before the 1949 outbreak, although there is evidence from other sources that it occurred in 1948. When deposited in dense, mature, softwood stands, the moths can give rise to outbreaks, but when they are deposited in young, open or mixed stands, the ensuing high populations soon decline unless reinforced by repeated invasions. Populations in New Brunswick showed gradual and general increases as early as 1947. It is thought probable that these increases resulted from the build-up of local populations through climatic release. The nearest highly populated centres were over 100 miles to the west in 1947. Later, invasions by moths from centres outside the Province may have hastened the process.

ROBERTSON (J.G.). **Paper Chromatography in Insect Taxonomy.** — *Canad. J. Zool.* 35 no. 3 pp. 411–419, 2 figs., 12 refs. Ottawa, 1957.

The following is virtually the author's summary. In an evaluation of the method of paper chromatography for taxonomic purposes [*cf. R.A.E.*, B 44 81], 18 species of Coleoptera, Lepidoptera, Diptera and Hymenoptera showed chemical differences. The analyses were complicated by pattern differences evident in larval, pupal and adult stages of some species. Geographic isolates of *Malacosoma disstria* Hb. and *Psila* (*Chamaepsila*) *rosae* (F.) and physiological entities within *Pristiphora erichsonii* (Htg.) show identical patterns; however, differences are found at specific levels. Paper chromatography is therefore a valuable taxonomic tool, especially as the technique is capable of considerable refinement.

Proceedings of the Tenth International Congress of Entomology, Montreal, August 17–25, 1956. Section on Behaviour, including Social Insects. — *Proc. 10th int. Congr. Ent.* 2 pp. 395–615. Ottawa, 1958. **Section on Ecology.** — *T.c.* pp. 617–784. **Section on Genetics, Cytology and Biometrics.** — *T.c.* pp. 785–1051.

The following are abstracts of selected papers containing hitherto unpublished information of which the text is printed in full in these sections [*cf. R.A.E.*, A 47 203].

MONTEITH (L.C.). **Influence of Host and its Food Plant on Host-finding by *Drino bohemica* Mesn. (Diptera: Tachinidae) and Interaction of other Factors**, pp. 603–606, 16 refs. Both the host species and their food-plants influence the finding of hosts by *Sturmia* (*Drino*) *bohemica* (Mesnil), and their relative importance was investigated in experiments carried out by methods described in an earlier paper [45 404]. When equal numbers of larvae of *Gilpinia* (*Diprion*) *hercyniae* (Htg.) and *Pikonema alaskensis* (Rohw.) on separate trees of white spruce (*Picea glauca*) were exposed simultaneously to attack by *S. bohemica*, the number of eggs laid was nearly seven times as great for *G. hercyniae* as for *P. alaskensis*, indicating that the stimulus from the host was greater than that from the food-plant. This finding was confirmed in a more elaborate test in which larvae of *G. hercyniae* on white spruce, *Neodiprion lecontei* (Fitch) on red pine [*Pinus resinosa*] and *N. sertifer* (Geoffr.) on Scots pine (*Pinus sylvestris*) were exposed together with larvae of *N. swainei* (Middleton) on *N. pratti banksianae* Rohw. on jack pine (*P. banksiana*), the two series being alternated eight times. The same individual trees were used in both series, but the order of preference for the different hosts, with (in brackets) the percentage of eggs laid on each, changed from *G. hercyniae* (54), *N. lecontei* (19), *N. sertifer* (18) and *N. swainei* (9) in the first to *G. hercyniae* (43), *N.p. banksianae* (22), *N. lecontei* (21) and *N. sertifer* (14) in the second. In a discussion of the factors known to influence host-finding [45 404; 46 127], it is stated that the stimuli produced by the food-plant and by the host probably act in sequence in the field and that there is a high degree of interaction between them.

PUTNAM (L.G.) & HANDFORD (R.H.). **Two-year and One-year Life Cycles in *Melanoplus bivittatus* (Say) (Orthoptera: Acrididae) in Western Canada**, pp. 651–656, 8 refs. The following is virtually the authors' abstract. *Melanoplus bivittatus* (Say) was until recently considered to have one generation per year throughout its range. It was noted, however, that populations of the grasshopper were high in certain fields in the Kersley district of British Columbia during 1948, 1950, 1952 and 1954 and extremely

low during 1949, 1951, 1953 and 1955, suggesting a two-year life-cycle there. Most of the eggs obtained in samples from the Kersley fields in 1953, and most of those obtained subsequently from laboratory-reared females of the same strain, required exposure to two periods of low temperature (corresponding to two winters under field conditions) before they would hatch; diapause apparently occurred at each of two stages in their embryological development. Most of the eggs from a Saskatchewan strain maintained under the same conditions as the Kersley strain hatched after a single period of diapause development at low temperature; this corresponds to one winter under field conditions and results in one generation per year.

HARPAZ (I.). **Bionomics of the 11-spotted Ladybird Beetle, *Coccinella undecimpunctata* L., in a subtropical Climate**, pp. 657—659, 6 refs. The following is based on the author's abstract. Although the adults of *Coccinella undecimpunctata* L., which is predacious on aphids, occur in the coastal plain of Israel throughout the year, reproduction is confined to two well defined periods, May—June and September—November. The duration of development of each of these two generations averages about 50 days, as the mean temperatures are similar in spring and in autumn. A partial third generation sometimes appears in autumn and may reach the adult stage before cold weather sets in. In laboratory tests, the larvae each consumed about 200 second-instar nymphs of *Aphis pomi* Deg., and the adults 800 during an active life of about 40 days. In view of the small number of generations a year, as compared with 20 or more for aphids, this limited feeding capacity, and its cannibalistic habits in the larval stage, the Coccinellid can be of no significance in preventing aphid increase.

FLESCHNER (C.A.). **Field Approach to Population Studies of Tetranychid Mites on *Citrus* and Avocado in California**, pp. 669—674, 3 refs. The following is largely the author's abstract. The field approach to population problems is considered in the light of information obtained in southern California from studies of three Tetranychid mites, *Panonychus* (*Metatetranychus*) *citri* (McG.) on *Citrus*, *Eotetranychus sexmaculatus* (Ril.) on *Citrus* and avocado, and *Oligonychus punicae* (Hirst) on avocado. Field populations of these mites were studied when protected from and when exposed to predators. In protecting mites from predators, hand-picking proved more dependable than the use of sleeve cages, insecticides or ants [*cf.* 40 84, etc.]. Predator activity was the most important single factor in restricting the mites to low population levels, though populations were also affected by the direct and indirect effects of insecticides and climate, the food-plant and mass migration [*cf.* 45 429].

BURNETT (T.). **A Model of Host-Parasite Interaction**, pp. 679—686, 3 graphs, 13 refs. The following is virtually the author's abstract. The effect of host-parasite interaction on the growth-form of a host-parasite population is usually masked by the great variation in physical factors that act on natural populations and by the limited environment available for the propagation of experimental populations. When the generations of host and parasite species are distinct, host-parasite interaction can be analysed by limiting the time of a generation and reducing the reproductive rate of the host. The growth-forms of *Trialeurodes vaporariorum* (Westw.) and its parasite, *Encarsia formosa* Gah., were recorded when host larvae were distributed, more or less uniformly, over the flat surface of a cage, 441 sq. in. in area, and exposed to female parasites for a "generation" period of 18 hours. The number of parasite eggs laid in each host was recorded; the number of parasitised hosts determined the number of adult parasites in the next generation, while the unparasitised hosts were considered to have doubled in number. At the beginning of the experiment, 22 hosts were exposed to 11 parasites (in 10 replicates), and the number

of hosts and parasites were recorded for the next 21 generations. There were two oscillations in the numbers of host and parasite. The observed growth-form follows generally that calculated from the equations of Nicholson & Bailey [*cf.* 24 6], but the second peak of both host and parasite was below expectation. This model appears satisfactory for the analysis of the influence of some physical and biotic factors on the interaction of *Trialeurodes* and *Encarsia*.

GRESSITT (J.L.). **Ecology of *Promecotheca papuana* Csiki, a Coconut Beetle**, pp. 747–753, 5 refs. The author reviews the bionomics and natural control of *Promecotheca papuana* Csiki on coconut in New Britain from the literature [*cf.* 29 337, etc.] and observations made during a visit in April–May 1956, and points out that outbreaks of this Hispid have occurred at intervals of 11–12 years in certain localities, although it is normally well controlled by indigenous parasites and the introduced *Pleurotropis parvulus* Ferrière. The outbreaks appear to be associated with a "one-stage" condition in the population of the beetle, and, although there is no certain evidence, this is probably caused by an increase in attack by the predacious mite, *Pediculoides* (*Pyemotes*) *ventricosus* (Newp.), as was the case with a related species in Fiji [*cf.* 25 191]. When such a condition is reached, it persists for up to two years and greatly reduces control by parasites. It may be due, however, to the effect of other predators or diseases.

HIRO (M.). **Ecological Studies on *Hydropsyche* in Japan**, pp. 779–780. Several species of *Hydropsyche* and related Trichoptera build their nests on the walls of water tunnels and reduce the flow. They have become of importance in electric power production in Japan, where many power plants show reduced output because of obstructed water tunnels, and a similar condition has been reported in California. A list of the species concerned in Japan is given followed by notes on their bionomics. The egg, larval and pupal stages last 15, 60–100 and 16–19 days, respectively, and the adults survive for 7–10 days. The larvae overwinter, and oviposition occurs between the end of March and the beginning of November and is commonest in June–July. The larvae avoid light, but the adults are positively phototactic and are attracted to light-traps. Several natural enemies of *Hydropsyche* are noted.

BEINGOLEA GUERRERO (O.). **Estudios morfométricos de fases de la langosta migratoria sudamericana, en el Perú (*Schistocerca cancellata* Serv.-*S. paranensis* Burm.)** [Morphometric Studies of Phases in the South American Migratory Locust (*S. cancellata*-*S. paranensis*) in Peru], pp. 1037–1051, 5 graphs, 3 refs. Solitary and gregarious phases have been distinguished in *Schistocerca cancellata* (Serv.) in Peru [*cf.* 45 327, etc.], and the results are given of a morphometric study of 23 males and 24 females of phase *gregaria* (*S. paranensis* (Burm.)), collected in a north-western district in 1945–48, when an outbreak was in progress, and 50 males and 50 females of phase *solitaria* collected in a permanent breeding centre in 1950–54. The 20 characters considered by Dirsh [43 336], and one other, were measured for the two sexes separately, but none was sufficient for the separation of the phases. The length of the elytron (E) and of the hind femur (F), the maximum width of the hind femur (A), and minimum width of the mesosternal interspace (mS), and the horizontal diameter of the eye (Oh) were selected for a study of ratios [43 336], and it was found that the phases could be separated with a high degree of probability for populations, though not for individuals, by means of the E/F, E/A, F/mS, Oh/mS and A/mS ratios. The E/F and E/A ratios are the simplest for use in the field.

CHANG (Hsüeh-tsu). Taxonomic Notes on the Codling Moth, *Carpocapsa pomonella* L. in Sinkiang. [*In Chinese.*]—*Acta ent. sin.* 7 no. 4 pp. 467–472, 5 figs., 7 refs. [Peking] 1957. (With a Summary in English.)

Cydia (*Carpocapsa*) *pomonella* (L.) has been observed of recent years damaging apple and pear in Sinkiang, where it has become the most important insect pest in orchards. To facilitate identification of this newly recorded pest in China, the taxonomic characters of all stages are described.

Distribution Maps of Insects Pests.—Series A, nos. 97–102. London, Commonw. Inst. Ent., 1959.

These maps are nos. 97–102 of a series already noticed [*R.A.E.*, A **40** 203; **46** 509] and deal, respectively, with *Pristiphora erichsonii* (Htg.), *Neodiprion sertifer* (Geoffr.), *Aphis craccivora* Koch, *Maconellicoccus* (*Phenacoccus*) *hirsutus* (Green), *Planococcus lilacinus* (Ckll.) and *Saccharicoccus sacchari* (Ckll.).

BIRD (J.). **A Whitefly-transmitted Mosaic of** *Jatropha gossypifolia*.—*Tech. Pap. P.R. agric. Exp. Sta.* no. 22, 35 pp., 10 figs., 12 refs. Río Piedras, 1957. (With a Summary in Spanish.)

Jatropha gossypifolia is a plant of no economic importance that occurs throughout the West Indies. It is affected by a mosaic disease in Porto Rico, and a similar disease has been observed on it in Jamaica, Martinique and Guadeloupe. Work on this disease was undertaken in Porto Rico as part of an investigation on the possible relations of virus diseases of weeds and those of plants of economic value, and the following is based on the author's summary of the results.

The virus was not transmissible by seed, by inoculation with expressed sap, or through dodder, but was transmitted from diseased to healthy *J. gossypifolia* by grafting and by *Bemisia tabaci* (Gennadius), which was found infesting diseased plants; virus-free progenies were obtained when viruliferous insects were allowed to oviposit on lower old leaves of *Jatropha*. Minimum acquisition and inoculation feeding periods of 2 hours and 10 minutes, respectively, were required for transmission, and single individuals readily infected healthy plants if fed on immature leaves. The virus was found to be of the persistent type.

Seedling tobacco plants were infected in the greenhouse by *B. tabaci* from infected *J. gossypifolia*, but not mature plants, and they developed symptoms closely resembling those reported elsewhere for the leaf-curl virus disease of tobacco [*cf. R.A.E.*, A 23 692]. A leaf-curl disease of tobacco was found to occur in Porto Rico, but attempts to recover the virus by means of *B. tabaci* failed. The symptoms were similar to, if not identical with, those recorded for tobacco leaf-curl in East Africa and India.

PAPER NOTICED BY TITLE ONLY.

LICHTENSTEIN (E.P.) & SCHULZ (K.R.). **Colorimetric Determination of Heptachlor in Soils and some Crops.**—*J. agric. Fd Chem.* **6** no. 11 pp. 848–849, 2 refs. Easton, Pa., 1958.

NOTICES

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